SCIENTIFIC AMERICAN

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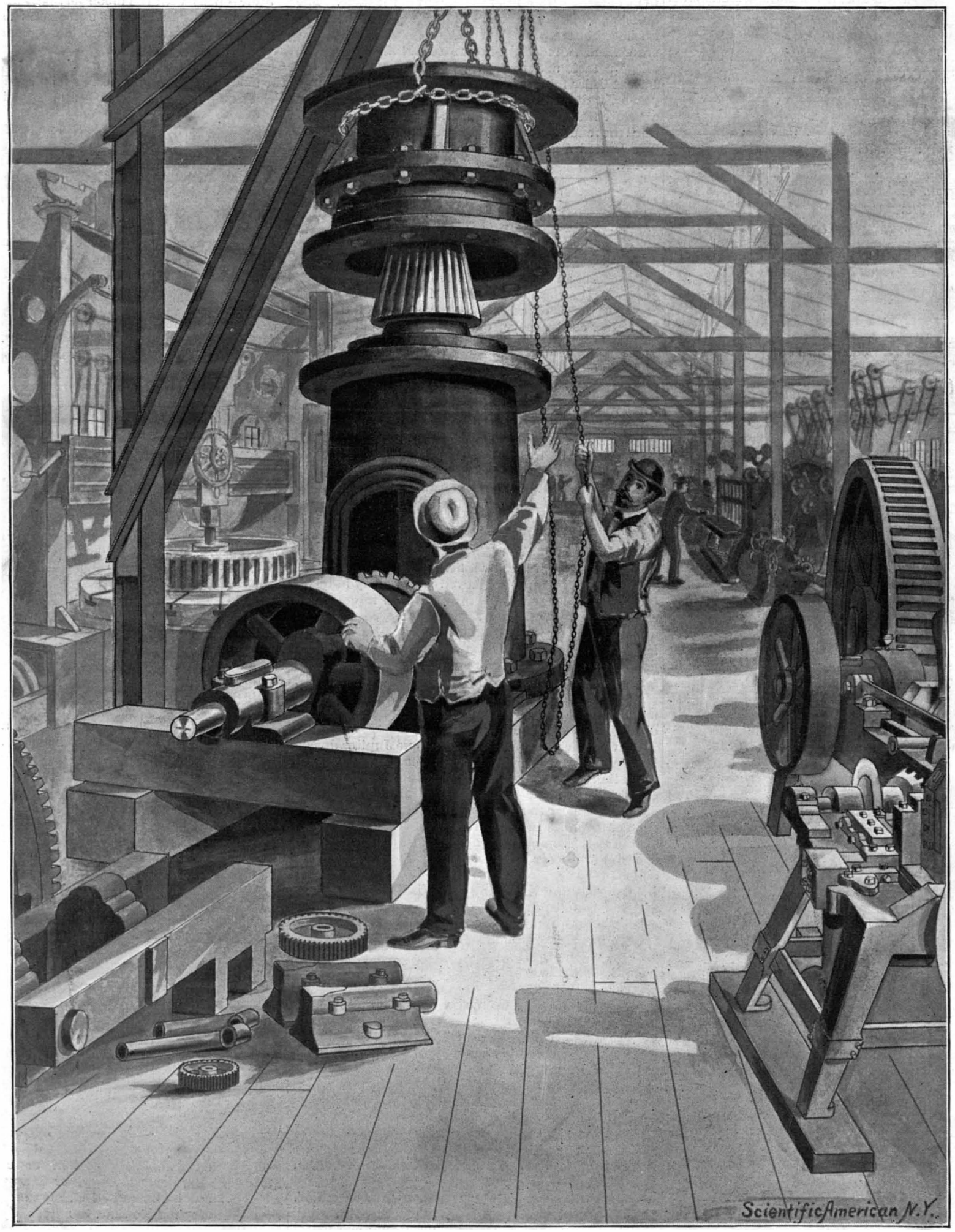
WORKS OF THE NATIONAL MACHINE COMPANY, OF TIFFIN, OHIO.

The National Machinery Company, of Tiffin, Ohio, a scene in whose works we present to our readers in the present issue, is an establishment devoted to the production of heavy machines and tools for manufacturers. This feature really is its most characteristic one. Thus it does not manufacture bolts and nuts, but makes the machinery for the manufacture of such articles. The drawbars of railroad cars, of which enormous quantities are used by the railroads in this country, are bent from the bar and left ready for welding by a special machine manufactured by this concern. Nail machinery, railroad spike machines, machines for forming, forging and bending, rock and ore crushers, special machinery for manufacturers, all these are typical products of this place.

The establishment includes a foundry covering an area of 80 by 100 feet, a pattern shop 40 by 150 feet, and the main shop, shown in our illustration, is 100 by 300 feet in area. The company is incorporated under the presidency of Mr. A. Brewer and began its existence in 1883. About 150 operators are employed. The scene in the main shop represents the setting up of the National rock and ore crusher, which is a notable example of the work done, interesting on more than one account. The machine weighs 33,000 pounds and represents one of the most advanced crushing apparatus yet produced. This point of interest is supplemented by the subjective one that the machine as



MAIN SHOP OF THE NATIONAL MANUFACTURING COMPANY, OF TIFFIN, OHIO.

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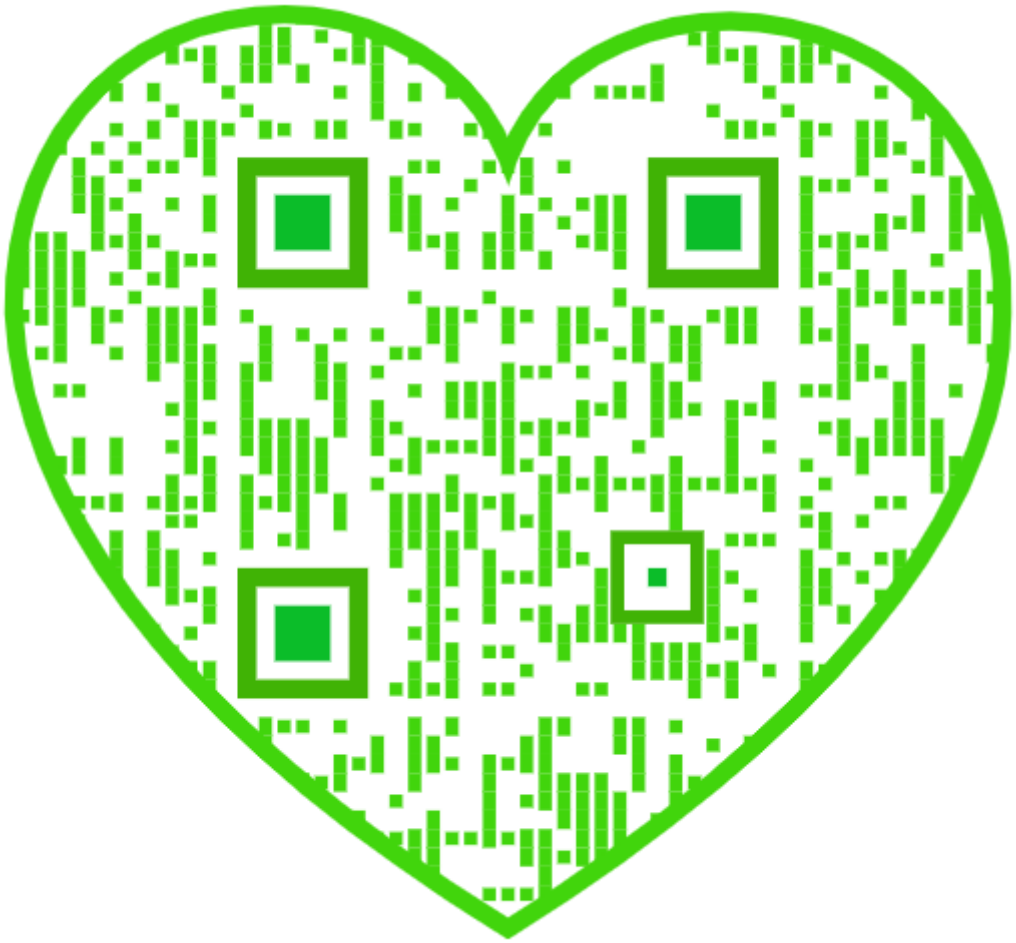

shown was to be shipped, when completed, to General Coxey, the leader of the famous "Coxey Army," which marched to Washington last year.

This is an example of one of the heavier machines produced, others running as high as 45,000 pounds each. The general view of the main shop shows a very complete plant and indicates the great facilities possessed by the company for work of the heavier class.

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THE BERLINER TELEPHONE DECISION.

It seldom falls to the lot of the federal government to appear so conspicuously in the courts as it has within the last few days and to accept in succession two such important and far-reaching defeats as those it has suffered in the income tax decision before the United States Supreme Court and in the Berliner patent decision in the United States Circuit Court of Appeals. It is not long since we noted in these columns the decision rendered by Judge Carpenter in the Circuit Court, in the suit brought by the government to annul the Berliner patent. The decision declared the patent to be invalid; it was based on the ground of wrongful delay in procuring the issue of the patent, in implying a want of diligence on the part of the applicant, all which seemed to afford a most equitable ground for declaring the patent invalid.

The second ground was more of the statutory class, referring to the issue of a prior patent to the same applicant for the same invention. On the 18th of May the United States Circuit Court of Appeals, to which the case had been brought on appeal by the Bell Telephone Company, reversed the decision of the Circuit Court, but allowed the appellee, which is the government, to file a motion as to the form of the judgment to be entered with a brief in support of the same. The decision, while a great triumph for the Bell Company, is somewhat tempered by this last clause, as the government has on file a motion to amend the bill so as to allege a tacit understanding with the officials of the Patent Office in the matter of the delay of the Berliner patent, which, if proved, would go to show possibly an absolute fraud. The case cannot be fully discussed until the rendering of the opinion of the Circuit Court. The United States will carry the case to the Supreme Court.

THE HEAVENS IN JUNE.

The planetary maneuvers in the evening sky during June will be not less attractive than they were in May. Mercury will not only be visible after sunset during the first half of the month, but that shy planet will perform an exceedingly interesting evolution with Jupiter. On the first of June Mercury will be seen about 6° west, or on the sunward side, of Jupiter. But, in consequence of its more rapid motion eastward, it will approach the giant planet, gaining about three-quarters of a degree upon the latter every day, and on the 8th will overtake it, passing on the north at a distance of only 47′. The nearest approach will occur at 10 o'clock in the morning. Afterward Mercury will continue to forge ahead of Jupiter until the afternoon of the 18th, when it will turn back and begin a rapid flight sunward, meeting and passing Jupiter on the south at a distance of 2° 34′ at 9 P. M. on the 21st. Then it will again distance its great competitor until it disappears in the solar rays.

Jupiter itself practically passes off the stage this month, getting too near the sun at the close to be well seen. It is still in the constellation Gemini.

Mars will remain in view a little longer than Jupiter, but the ruddy planet has moved so far away in its orbit that it no longer possesses any special interest as a telescopic object, while for the naked eye it has sunk into comparative insignificance. The question whether Mars has or has not an atmosphere sufficient to support life resembling that of the earth has not yet been settled to the general satisfaction of the disputants. Mars passes from Gemini into Cancer early in the month and continues in the last named constellation during the remainder of June.

Venus, which so completely outshone Jupiter during May, will grow still brighter in June. There is an education in the science of light in a study of the causes which make a planet less than 8,000 miles in diameter appear so much brighter than a planet more than 86,000 miles in diameter. The primary cause is, of course, the comparative nearness of the former to the sun and to the earth. Venus, seen with the telescope, will be very near the half-moon phase at the end of the month. She is moving eastward and southward and will be in conjunction with Mars on June 5th at 5 o'clock in the morning. From Gemini she passes on the 5th into Cancer, and from Cancer on the 25th into Leo.

Neptune in Taurus is too near the sun to be observed.

Saturn, remaining in Virgo, some 10° almost directly east of Spica, is the most attractive planet on the list for telescopic observation. The smallest telescope worthy of the name suffices to reveal the principal charm of Saturn, the wonderful system of rings suspended above its equator. It gives the observer a picturesque sense of the enormous distance across which he is looking to recall, while his eye is at the telescope, the fact that those rings measure almost 170,000 miles from end to end of the elliptical figure which they present. There is no lack of exhibition space in the solar system.

The spectroscopic discovery, made by Professor J. E. Keeler, of the Allegheny Observatory, that the rings of Saturn actually consist—as Maxwell long ago mathematically proved that they must do—of swarms of small satellites or meteorites, is one of the finest of recent achievements in practical astronomy. Professor Keeler's proof, which is wonderfully interesting as well as convincing, consists in photographs of the spectrum of the planet and its rings, which show the spectral lines displaced in such a way as to indicate that the inner edge of the ring system revolves around the planet nearly a mile and a quarter in a second faster than the outer and nearly two miles and a quarter faster than the outer edge. The movements of the various parts of the system as thus ascertained agree satisfactorily with the velocities that satellites revolving around the planet at corresponding distances should have according to Kepler's third law of planetary motion.

Uranus remains near the star Nu in Libra and some 3° nearly east of Alpha Librae. It is about equal in brightness to a star of the sixth magnitude and can consequently be seen with the naked eye. It may be recognized with the aid of a field glass by noticing for several nights in succession its position with reference to small stars near it. If careful charts are drawn of the field of view, the motion of the planet will soon become manifest, and such an exercise is good discipline for a beginner in stellar observation.

June opens with the moon just past first quarter in Virgo. The moon fulls at 6 o'clock on the morning of the 7th in Sagittarius, reaches last quarter in Pisces at 6:28 A. M. on the 15th and becomes new moon in Gemini at 4:51 P. M. on the 22d. The second moon of the month reaches first quarter at 1 minute past 9 o'clock on the morning of the 29th, when it will be in Virgo, about 8° west of Spica.

The moon visits the planets in June as follows: Saturn on the 4th, at 12:58 A. M.; Uranus on the 5th, at 2:56 A. M.; Neptune on the 21st, at 4:33 P. M.; Mercury on the 23d, at 12:14 P. M.; Jupiter on the 23d, at 1:43 P. M.; Mars on the 25th, at 6:27 A. M.; and Venus on the 25th, at 11:11 P. M. This last will be a comparatively close conjunction.

The astronomical summer begins at noon on the 21st.

Among telescopic objects for amateurs that will be well situated for observation this month (in addition to those described last month which still remain in view) are the following:

The great star cluster, M 13, in Hercules. This is an impressive object even when seen with only a 3 inch or 4 inch telescope. Those who have 4½ or 5 inch telescopes may try them upon the binary star Zeta Herculis. The distance of the components at present does not exceed a second and a quarter.

More interesting to the ordinary star gazer in search of the picturesque, and easy to divide with a 3 inch glass, is Alpha Herculis. Here a striking contrast of color will be noticed, the larger star being orange and the smaller emerald green. The distance is about 4½ seconds. Rho Herculis, whose components are nearly a second closer than those of Alpha, shows the combination of a white with a green star. Still another interesting double in Hercules is the star 95, whose two components are 6″ apart, the larger being green and the smaller red.

A good 4½ inch telescope, and sometimes even a smaller aperture than that, will show the celebrated companion of the great red star Antares in Scorpio. The distance is three seconds, and the color of the little companion is a vivid green. This is one of the finest sights among the double stars. While surveying Scorpio the observer should not neglect to look at Beta, a very easy double, which also exhibits a contrast of colors. The larger star is white and the smaller blue, the distance being about thirteen seconds. Its neighbor Nu is a fine triple, with which a 4 inch glass, or even a 3½ inch, is easily capable of dealing. The two nearest stars are about a second and three-quarters apart; the farthest star is distant forty seconds. For a beautiful combination of orange with blue look at the star 39 Ophiuchi. The components are twelve seconds apart, so that even a 2 inch glass will separate them.

As remarked last month, these objects cannot be readily found without the aid of a star atlas, a book that ought to stand next to the dictionary in all households where intellectual recreation is favored.

GARRETT P. SERVISS.

THE MOON'S STORY.*

BY SIR ROBERT BALL, LOWNDEAN PROFESSOR OF ASTRONOMY AND GEOMETRY AT CAMBRIDGE, ENG. FORMERLY ROYAL ASTRONOMER OF IRELAND.

I do not think there is any chapter in modern science more remarkable than that which I here propose to describe It has, indeed, all the elements of a romance. I am to sketch an event of the very greatest moment in the history of this universe, which occurred at a period of the most extreme antiquity, and has been discovered in the most remarkable manner.

The period of which I write is far more ancient than that of the Pyramids of Egypt, or of any other monuments erected by human effort. It is even more early than that very remote time, hundreds of thousands of

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years ago, when man himself first came upon this globe. Our retrospect has to pierce right through those vastly protracted cycles which the geologists have opened up to us. We speak of a period long anterior to the ages during which our continents were being sculptured into their present mountain chains and river courses. We have to look through those periods still earlier, when great animals, long extinct, flourished on this earth. The time of which I write is more remote than that very remarkable epoch in earth history during which the great coal forests flourished. It is earlier than the supreme moment, countless millions of years ago, when living organisms first became inhabitants of this globe. Even here, however, our retrospect must not stop. We have yet once more to look back through certain anterior periods to a time when our earth was in its earliest youth. The chapter of history about which I am now writing is indeed in the very dawn of things terrestrial.

It might be thought that it would be utterly impossible for us to learn anything with regard to what took place at a time so immeasurably anterior to all sources of tradition, and indeed to all the ordinary channels for obtaining knowledge by observation. It however fortunately happens that the darkness of this early period is illumined by a bright and steady source of light which will never deceive us if only we will follow it properly. Our trustworthy guide is to be the pen of the mathematician, for it is well known that, unless we are going to dispute the fundamental proposition that two and two make four, we cannot impugn the truths which mathematics discloses. This science knows no boundaries of space. It recognizes no limits in time. It is ever ready for discussing operations which take place either in the millionth part of a second or in the lapse of uncounted millions of centuries. The processes of mathematics are alike available for tracing out the delicate movements in the interior of a molecule not one millionth part of the size of a grain of sand or for investigating the properties of space so vast that the whole solar system only occupies an inconsiderable point by comparison. Let us therefore see what this infallible guide has to teach us with regard to that momentous epoch in the history of our system when the moon was born.

Our argument proceeds from an extremely simple and familiar matter. Every one who has ever been on the sea shore knows the daily ebb and flow of the waters, which we call the tides. Long ere the true nature of the forces by which the moon acts upon the sea was understood, the fact that there was a connection between the tides and the moon had become certainly known. Indeed, the daily observation of a fisherman or of any one whose business was concerned with the great deep would have taught him that the time of high water and the time of full moon stood at each place in a certain definite relation. The fisherman might not have understood the precise influence of the moon upon the tides, but if he had observed, as he might in some places, that when the moon was full the tide was high at 10 o'clock in the morning, it would be perfectly obvious to him that the moon had some special relation to this ebbing and flowing of the ocean. Indeed, we are told of some savage race who, recognizing that the moon and the tides must be associated, were still in some considerable doubt as to whether it was the moon which was the cause of the tides, or the tides which were the cause of the moon.

The ebbing and flowing of the tide opens up this chapter in remote history, which we can now explore, mainly by the help of the researches of Prof. George Darwin. For, as the tides course backward and forward, sweeping to and fro vast volumes of water, it is obvious that the tides must be doing work. In fact, in some places the tides have been made to do useful work. If the water as it rises be impounded in a large reservoir, it can be made to turn a water wheel as it enters, while another water wheel can be driven as the reservoir empties itself a few hours later. Thus we produce a tidal mill. It is quite true that, so long as coal remains tolerably cheap and steam power is consequently readily available, it is not often possible to employ the direct power of the tides in an economical manner. For our purpose it is merely necessary to note that, day after day, week after week, year after year, the tides must be incessantly doing work of some kind or other.

Every practical man knows that a certain quantity of work can only be done by the expenditure of a certain quantity of energy. He also knows that there is in nature no such thing as the creation of energy. It is just as impossible to create out of nothing the energy which should lift an ounce weight through a single inch as it would be to create a loaf of bread out of nothing. If, therefore, the tides are doing work, and we have seen that they undoubtedly are doing work, it follows that there must be some source of energy on which the tides are enabled to draw. A steam engine is able to put forth power because of the energy developed from the coal which is continually supplied to the furnace. But where is the equivalent of the coal in the great tidal engine? We might at first hazard the supposition that, as the moon is the cause of the tides, so we must look to the moon to provide the energy by which the tides do their work. This is, however, not exactly the case. The match which lights the fire under a steam boiler is in one sense no doubt the cause of the energy developed; but we do not, therefore, assert that the power of the engine is derived from the match. It comes, rather, from the fuel whose consumption is started by the match. In like manner, though the moon's attraction causes the tides, yet it is not from the moon that the tidal energy is drawn. There is only one possible source for the energy necessary to sustain the tides. Every one who is conversant with mechanical matters knows the important duty which the flywheel performs in a mill. The flywheel, in fact, may be considered as a reservoir into which the engine pours the power generated with each stroke of the piston, while the machinery in the mill draws on this accumulated store of power in the flywheel. If the engine is stopped, the flywheel may yet give a turn or two, for the energy which it contains may be still sufficient to drive for a few seconds the machinery through the mill. But the store of energy in the flywheel would necessarily become speedily exhausted and the flywheel come to rest unless it were continually replenished by the action of the engine.

The earth may be regarded as a mighty flywheels which contains a prodigious store of energy. That energy is, however, never added to, for there is no engine available. If, however, no energy were withdrawn from the earth, then the globe would continue to spin round its axis once every twenty-four hour, forever. As however the tides need energy to get through their work, they abstract what they require from the store which they find at hand in the rotation of the earth. Next time you see the tides scouring up and down a river you may reflect that the power which impels that mass of water to and fro has been obtained solely at the expense of the spinning of our globe. Indeed, the little child who digs a moat in the sand, which is filled by the rising tide, affects, to a certain extent, the revolution of this earth about its axis.

This withdrawal of energy from the earth is incessantly taking place along almost every coast. From day to day, from century to century, from æon to æon, energy is daily being withdrawn and daily wasted, never again to be restored. As the earth has no other means of replenishing its stores, the consequence is inevitable. The quantity of energy due to the rotation of the earth must be gradually declining. Stated in this way, perhaps the intimation is not very alarming, but, placed in other words, the results at which we have arrived assume the more practical expression that the tides must be gradually checking the speed with which the earth turns round. The tides must, in fact, be increasing the length of the day. In consequence of the tides which ripple to and fro on our shores, and which flow in and flow out of estuaries and rivers, to-day is longer than yesterday, and yesterday is longer than the day before. I may, however, admit at once that the change thus produced is not very appreciable when only moderate periods of time are considered. Indeed, the alteration in the length of the day from this cause amounts to no more than a fraction of a second in a period of a thousand years. Even in the lapse ordinary history, there is no recognizable change in the length of the day. But the importance of our argument is hardly affected by the circumstance that the rate at which the day is lengthening is a very slow one. The really significant point is that this change is always taking place, and lies always in the same direction. It is this latter circumstance which gives the present doctrine its great importance as a factor in the development of the earth-moon system.

We are accustomed in astronomy to reason about movements which advance for vast periods in one direction, and then become reversed. Such movements as this are, however, not the real architects of the universe, for that which is done during one cycle of years is undone during the next. But the tides are ever in operation, and their influence tends ever in the same direction. Consequently the alteration in the length of the day is continually in progress, and in the course of illimitable ages its effects accumulate to a startling magnitude.

The earth now revolves on its axis once in twenty-four hours. There was a time, millions of years ago, very likely, when it revolved once in twenty-three hours. Earlier still it must have spun on its axis in twenty-two hours, while this succeeded a time when the day was only twenty hours. The very same arguments applied in those times which apply at the present, so that if we strain our vision back into the excessively remote past, we find the earth spinning ever more and more rapidly, until at last we discern an epoch when the length of the day, having declined to eight hours and seven hours, had at last sunk to something like five or six hours. This is the time when the moon's story commences. At this eventful period the earth accomplished about four revolutions in the same time that it now requires for a single one. We do not attempt to assign the antiquity of this critical moment. It must certainly have been far earlier than the time when this earth became fitted for the reception of organized life. It must have been at least many millions of years ago. If it be thought that the vagueness of our chronology is rather unsatisfactory, then it must be remembered that even historians who have human records and monuments to guide them are still often in utter uncertainty as to the periods during which mighty empires flourished, or as to the dates at which great dynasties rose or perished.

But our story has another side to it. Among the profoundest laws of nature is that which asserts that action and reaction are equal and opposite. We have seen that the moon is the cause of the tides, and we have further seen that tides act as a brake to check the speed with which the earth is rotating. This is the action of the moon upon the earth; and now let us consider the reaction with which this action must be inevitably accompanied. In our ordinary experience we observe that a man who is annoyed by another feels an unregenerate impulse to push the annoying agent away as far as possible. This is exactly the form which the reaction of the earth assumes. It is annoyed by the moon, and accordingly it strives to push the moon away. Just as the moon, by its action on the earth, through the medium of the tides, tends to check the speed with which the earth is rotating on its axis, so the earth reacts on the moon, and compels the satellite to adopt a continuous retreat. The moon is therefore gradually receding. It is further from the earth to-day than it was yesterday, it will be further to-morrow than it is to-day. The process is never reversed, it never even ceases. The consequence is a continuous growth in the size of the track which the moon describes around the earth. It is quite true that this growth is a slow one, so too the growth of the oak is imperceptible from day to day, though in the lapse of centuries the tree attains a magnificent stature. The enlargement of the moon's orbit, though imperceptible from month to month or even from century to century, has revolutionized our system in the lapse of many millions of years.

Looking back through the mists of time, we see the moon ever drawing nearer and nearer to the earth. Our satellite now revolves at a distance of 240,000 miles, but there was a time when that distance was no more than 200,000 miles. There was a time, millions of years ago, no doubt, when the moon was but 100,000 miles away, and as we look further and further back, we see the moon ever drawing closer and closer to the earth, until at last we discern the critical period in earth-moon history, when our globe was spinning round in a period of about five or six hours. The moon, instead of revolving where we now find it, was then actually close to the earth, earlier still it was in fact touching our globe, and the moon and the earth were revolving each around the other, like a foot ball and a tennis ball actually fastened together.

It is impossible to resist taking one step further. We know that the earth was at that early period a soft molten mass of matter, spinning round rapidly. The speed seems to have been so great that a rupture took place, a portion of the molten matter broke away from the parent globe, and the fragments coalesced into a small globe. That the moon was thus born of our earth uncounted millions of years ago is the lesson which mathematics declares it learns from the murmur of the tides.

New Telephone Transmitter.

Mr. C. F. Dunderdale, of Chicago, has recently brought out a type of telephone transmitter possessing several novel features. While recognizing the good qualities of a granular carbon in a transmitter, the tendency to packing has to be avoided, and this he has secured by means of a constant rotation of the case containing the granules, so that the carbon granules are in a constant state of reversal of position, thus preventing their settling and the ensuing separation of the grains, the finer from the coarser, the former collecting at the bottom, and the latter at the top, and which the shaking only aggravated and increased the tendency to solidify.

One of the means of accomplishing this result is to provide a lever and ratchet movement, the lever being the support hook of the receiver, the act of hanging up and taking down of which causes the rotation to be secured automatically.

Every characteristic of the voice is preserved, whether the transmitter is shouted at or whispered into, all extra-vibratory sounds or echoes being eliminated.

The St. Charles, Mo., telephone exchange is fitted up with these instruments, and users there, it is asserted, can stand off thirty feet from the transmitter and talk in an ordinary tone of voice and have their words clearly transmitted to the distant point.

IF a match is held to a celluloid billiard ball, the ball will catch fire and burn.

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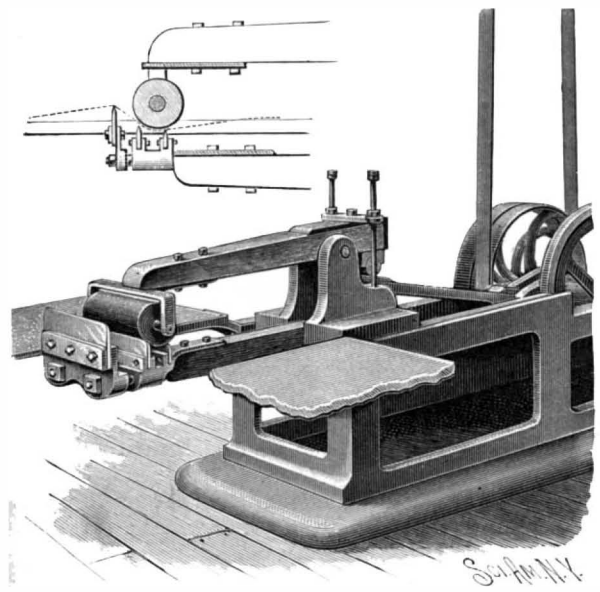
A MACHINE FOR STAKING LEATHER OR SKINS.

The illustration represents an improvement in machines employing a main and a blind blade, over which a roller is movable up and down, a supplemental blade being arranged in front of the roller to give the machine a double action, and facilitate the more thorough stretching and working of the skin. A patent has been granted for this invention to Mr. Richard Holmes, of No. 939 North Front Street, Philadelphia, Pa. The lower jaw, as in the ordinary machine, is slidable in a suitable frame, and fulcrumed on this jaw is an upper jaw, a roller at the rear end of which is engaged by a pitman, to give to the jaw, and a roller



HOLMES' LEATHER STAKING MACHINE.

carried at its forward end, an up and down movement. The lower jaw has a head which carries main and blind blades over which the roller moves, and in front of these is an extra blade, having vertical slots in its body to receive the bolts by which the blade is adjustably fastened to the head at the desired height, the skin being worked between the roller and the blades as indicated by the dotted lines in the small figure. The drawing of the skin over the extra blade is designed to give it an additional stretch, insuring additional scraping and also increasing its measurement.

The Bower Birds of New Guinea.

Every one has heard of the bower bird—Chlamydera—who constructs a play ground or garden of delight, adorning it with all sorts of attractive objects, either for his own whimsical purposes or to please his mate. The bower is some little distance through, perhaps thirty inches along the ground, and is composed of short twigs and sticks so placed as to form a half-roofed tunnel. Here the bird passes much of his time, diverts his mate by adding to their resort or by showing the gay material he has picked up, and in various ways manifests his appreciation of his own ingenious devices. He is a plain fellow in his own dress, though his taste is for the gaudy and meretricious; his size too is small in proportion to the Castle of Indolence he rears, for this is no nest, this retreat of his, but a pleasure house, a place of retirement, quiet amusement, or rollicking sport. His nursery is a different thing altogether, and is placed elsewhere. In his bower he gives his fancy full swing; he brings hither to garnish it every bright article he can discover, and lays a considerable territory under tribute to minister to his beloved habit, and so prodigal is he of his acquired treasures that the approaches to his singular aboed are strewn with spoils. Nothing seems to come amiss, hence he is as eager to possess himself of old bones, shells, stones, and all kinds of miscellanea, as bits of metal, flowers, leaves, dropped feathers, etc., although as a rule glittering objects prevail, obviously collected for decorative purposes. It is apparent that with so much evidence in plain sight, the little builder could not well conceal his structure, nor indeed was it the probable intention to do so; it was far easier to hide the real nest, and this has been done so effectually that the most persevering efforts toward discovery have gone unrewarded. It is not likely, however, that arbor and nest are very far apart.

The Chlamydera cerviniventris or fawn-breasted bower bird is enough like the common female robin of this country to be mistaken for her. The bird is very plain throughout, the nearest approach to brightness, and that but slight, being on the breast and abdomen, where a brownish yellow tinge occurs. The buff throat is streaked with dull yellow. The upper parts are uniformly drab or slate. It is rather longer than our robin—about twelve inches—with tail and wings extended more than strict proportions would permit. The bill is short and black, eyes are dark, legs and feet black. The male is said to sing sweetly, thus adding another accomplishment to his faculty of pleasing his mate as well as himself.

Another bower bird of New Guinea is the gardener—Amblyornis inornatus—who builds his hut or arbor of a triangular shape, set back against the trunk of a tree; in front he scatters the usual assortment of shining, smooth, and curious objects together with perishable substances, such as small plants, flowers, insects, fruit and fungi, removing them carefully when they become offensive or timeworn. This little virtuoso is plain in color, a yellowish red predominating, and in size and general appearance not unlike a large brown thrasher. He seems always busy and, indeed, must be, for the nature of his work requires unflagging diligence, but the time of greatest activity probably is during the pairing season.

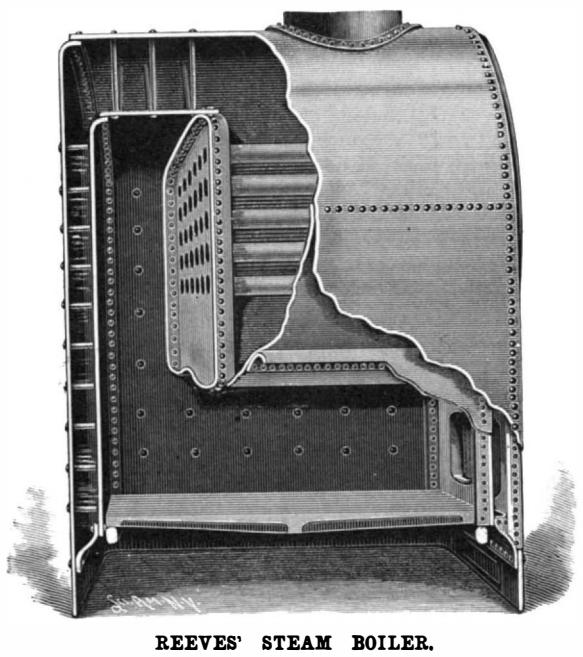
The best authorities describe the cabin of the gardener as built around the central stem of some bush, or as inclosing a cluster of shoots; in front the garden is placed, and is set out with that strangely rational though fantastic system of horticulture that has gained the bird its name. If there is no growth in the garden, we may infer that this branch of cultivation formed no part of the grand design; the results were all that was sought and these were to be always above ground. These birds have been classified by some naturalists with the Paridisea, though nothing in their appearance, habits or song (they are said to sing sweetly) seems to bear out such assignment.

This curious and fascinating bird is very local in its range, being confined so far as known to the Arfak Mountains in the northwest of New Guinea. It is only of recent years that it has been studied scientifically. Mr. Wallace knew nothing of it nor have naturalists since his visit to the great island added much to our knowledge. Dr. Becceari was the first to introduce the gardener to the world, and his graphic account of the abode of the little artificer has not been surpassed in merit nor greatly amplified in details by subsequent investigators. The Italian traveler, as in a picture, shows the hut or cabin close upon a small, flower besprinkled meadow. It is built around the stem of a little tree as thick and tall as an ordinary walking stick. The materials used are moss chiefly, and form a structure about three feet in diameter.

In shape the nest is conical, reminding one irresistibly in its whole appearance of the head covering Robinson Crusoe is usually represented as wearing. Inside is a little gallery or runway built along the walls. The garden is arranged before the hut decked out as we have seen. Amblyornis—simple in attire and coloring as his specific name indicates—is now a favorite illustration with theorists of the adaptation of animate life to its surroundings. Certainly its dun and sober clothing assimilates easily with the tones of soil and vegetation around. Its home too, with all its adornments, harmonizes with, indeed forms a part, of the gay green wood.—G. S. Mead, in the American Naturalist.

AN IMPROVED BOILER.

In this boiler the crown sheet and fire box sides are united by curved riveted flanges extended from the upper portion of the sides of the fire box, a part of the crown sheet extending through the water compartment. The improvement has been patented by Mr. Richard Reeves, of Toledo, Ohio. Our illustration affords a side view of the boiler, with portions of the shell and interior broken away. The fire box terminates at its rear end in a flue chamber, and the bottom part of the invertedly curved crown sheet is connected by rivets at its rear end with a flange of the flue sheet conforming to the shape of the crown sheet. The rear ends of the flues are supported by the flue sheet, and the flue chamber has a U-shaped crown sheet and a rear head, the letter being riveted at its sides and top to the crown sheet, and both the crown sheet and head being connected by stay bolts with the shell and the exterior head. The flue chamber is thus properly supported for the water to circulate around it, and the boiler affords a large heating surface in a comparatively small space.

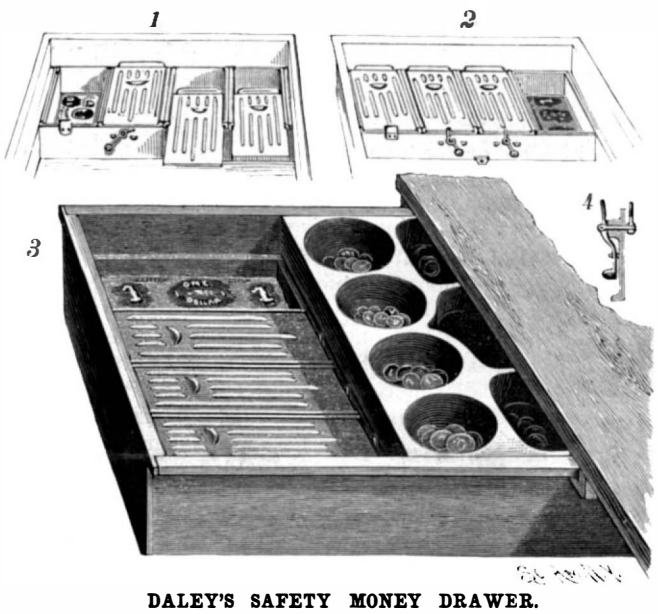


REEVES' STEAM BOILER.

A SAFETY MONEY DRAWER.

To prevent mistakes in making change, and to defeat any attempt on the part of a purchaser to make the tradesman believe that a bill of a larger denomination has been given him than that actually handed in, Mr. Michael R. Daley, of Fall River, Mass., has invented and patented the improvement represented in the accompanying illustration. Beneath the sliding tray containing pockets for small change, the till is divided into four front compartments for bills, the first compartment for one dollar bills, the second for twos, the third for fives, and the fourth for tens and those of higher denomination, there being at the back of the till an alarm lock of the usual construction.

Over these bill compartments are three separate movable covers, sliding in guides to one side or the other, thus always leaving one compartment open, it being the principle of the invention to leave open the compartment in which is placed the bill received, that it may be in sight until the transaction is completed, and so that this bill only will be seen when the drawer is again opened. In Figs. 2 and 3 in the illustration the $1 compartment is represented as open, and all the other compartments are locked, except as they may



DALEY'S SAFETY MONEY DRAWER.

be opened by moving their covers toward the left, while, as shown in Fig. 1, with the $10 compartment at the right open, any of the other compartments may be opened by sliding its cover rearwardly.

To lock the lids of compartments 2, 3, and 4, so that they will not slide backward except when they have an open compartment at the right, a simple locking device, as shown in Fig. 4, is pivoted in the rear wall of compartments 2 and 3, while at the rear of compartment 4 is a permanent stop. An arm of this locking device, in the rear of the compartment, is in vertical position when all the covers are pushed to the right, but on pushing the covers to the left, either one or all of them may be moved to the rear, the locking arms being then held down by the covers. In this way all the lids to the right of an open compartment are locked, while those to the left are free to be opened, and in making change when the drawer is operated according to this system, bills can only be taken from compartments holding lower denominations than the bill which has been taken in, which lies in the open compartment. When the drawer is pulled open there can be only a bill of one denomination in view, the bill that was taken in last.

The Screw Propeller.

It is interesting to learn from a paper read at the Institute of Civil Engineers by no less authorities than Messrs. S. W. Barnaby and Thornycroft, that in their opinion the present speed attained by the screw propeller has in the fastest craft now afloat approached the limit of efficiency. The Marine Engineer says: It will soon be a question, therefore, if this view be correct, not as to the comparative merits of twin and triple screws, but as to the screw in comparison with other methods of propulsion. Here is a vast field for experiment and research. We know neither the paddle wheel nor any modification, therefore, will help us, even if it were more efficient at high speeds, because of its vulnerability. We must have some mode of applying the power below the water line.

GERMANY is now the only country whose universities do not admit women students.

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GAS ENGINES FOR ELECTRIC LIGHTING PLANT.

In connection with the new station, and the extensive alterations recently carried out at Leicester, the Midland Railway Company has put down the largest and most efficient electric plant driven by gas engines in this country. We are enabled to give an illustration of the engine and dynamo room, and also a few particulars of the plant. The motive power consists of four large gas engines and two smaller, and are all made by Crossley Brothers, of Openshaw, Manchester. They are all built on their well known lines, and are specially fitted for driving dynamos with the necessary steadiness. Each of the four large engines is of 25 nominal horse power, capable of giving off 40 brake horse power as a safe working load with Dowson gas; and instead of the two overhung flywheels usually employed, one heavy flywheel, 7 feet 6 inches diameter by 19 inches wide, and weighing 4 tons 5 hundredweight, is fitted on each engine, with a massive outend bearing and pedestal for supporting the end of the shaft. The engines run at two hundred revolutions per minute, and with the means adopted very great steadiness is obtained. The face of the flywheels is slightly rounded, and the dynamos are driven direct from it. The crankshafts are cut out of solid steel forgings and are machined and polished all over, thus adding materially to the appearance of the engines. As is usual in all the engines made by Messrs. Crossley Brothers, the cylinders are fitted with loose liners, made like the pistons of specially hard metal, so that when they are worn beyond the stage at which reboring is possible, they can be renewed at the smallest possible cost. Owing to the high speed at which the engines run, special attention has been paid to the bearings, and to all the parts of the engines, with a view to easy maintenance and facility of renewals at the least cost.

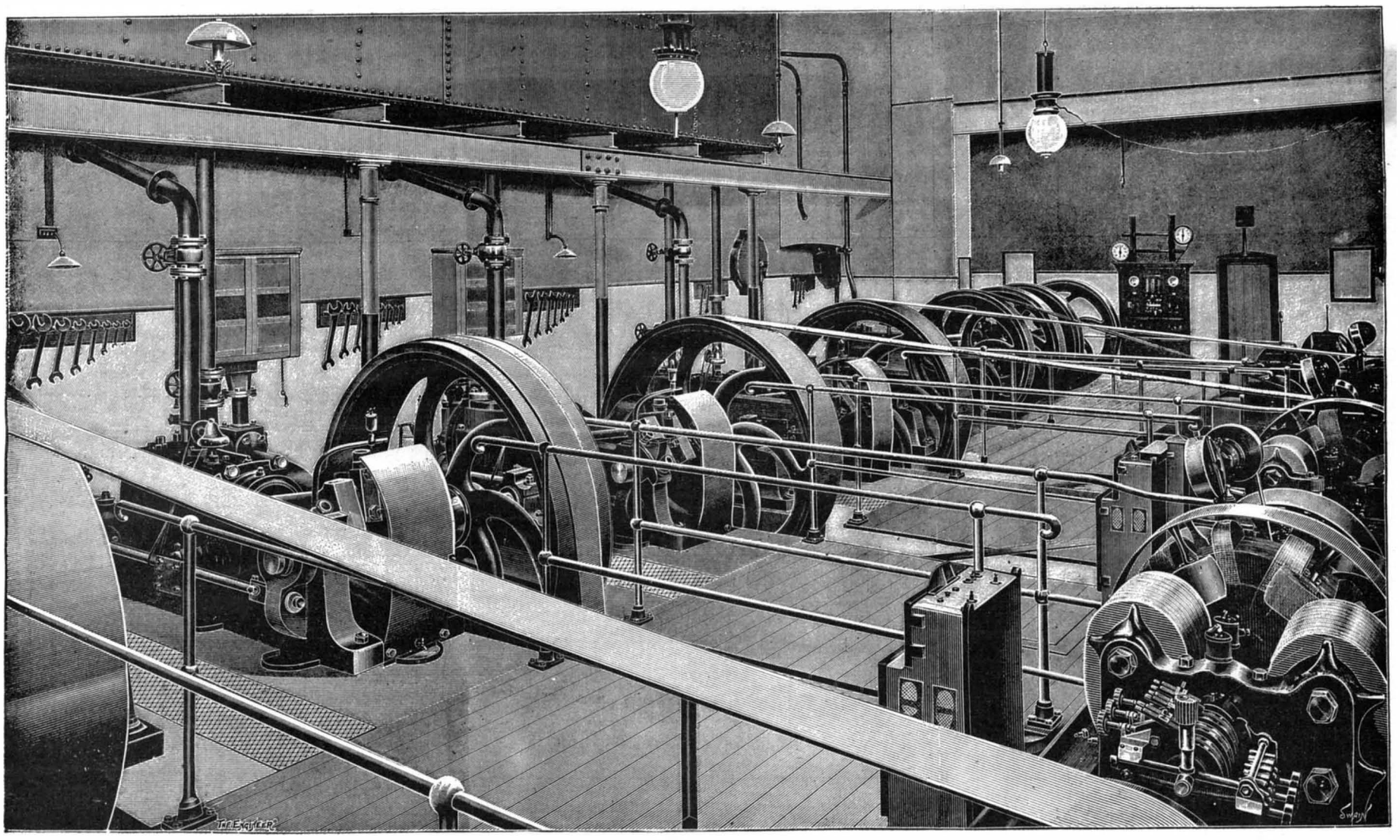
As it is essential that when once started the engines should run without intermission until their work is done, automatic lubricators have been fitted to all the vital parts. A novel feature in connection with these engines is the new igniting arrangement recently brought out by Messrs. Crossley. Instead of the metal tubes, which are short lived, Messrs. Crossley now use a short porcelain tube, about 3 inches long, which, if not destroyed by careless handling, is imperishable. It is quickly heated, thus reducing the time required for starting after the burner is lighted to about a minute and a half, besides being low in first cost. The engines are started by Crossley's self-starting apparatus, which enables an engine to be set in motion with nearly half load on. Thus fast and loose pulleys on the dynamo, or on other machinery the engine has to drive, are rendered in many cases unnecessary.

The two smaller engines at Leicester are each of 14 nominal horse power, capable of working up to 25 brake horse power with coal gas, and are each fitted with two overhung flywheels running at 200 revolutions per minute. Each engine is fitted with governors used for electric lighting work, and is generally on the lines of the larger engines previously described. Although the heavy flywheels militate against the efficiency of the engines, it costs less to store up the necessary energy to insure steady running by increasing the flywheel power of the engine than it would to achieve the same result on the dynamo.

For the jacket water for these engines one large tank is fixed on columns and girders, and contains sufficient water for cooling the cylinders of the engines even if all were working at once. Under ordinary circumstances the engines are worked with Dowson gas, but arrangements are made whereby, in the event of anything being out of order with the gas plant, the engines can be immediately turned on to coal gas from the town's mains. Three of the four larger engines are connected to Brush series arc-lighting machines, capable of driving fifty 2,000 candle power lamps each; the fourth large engine driving an incandescent machine of 300 amperes.. Each of the smaller engines drives a small machine for incandescent lighting, giving an output of 125 amperes at 115 volts. The arc lighting is required for the goods yards and sheds belonging to the Midland and London and Northwestern Railway Companies, and for the platforms, etc., of the new passenger station. The incandescent lighting is employed for the refreshment rooms, dining rooms, and offices.

The Dowson gas plant is placed in a separate building adjoining the engine house. There are two gas generators, and each has a gas cooler, hydraulic box, coke scrubber and sawdust scrubber. Space has been left for a third set, which has not yet been supplied. The gasholder is 16 feet diameter by 10 feet deep. There are two small vertical boilers, but only one is used, the other being in reserve. We have no recent data as to the working, but we may mention that toward the end of last year they were working three 25 horse power and one 14 horse power from 5 P. M. or 6 P. M. to 10 P. M. or 11 P. M., and that one generator made gas enough. From 10 P. M. or 11 P. M. to 5 A. M. or 7 A. M. there were two 25 horse power and one 14 horse power, and during this time the production of gas was reduced to suit the smaller load. At that time all the arc lamps were not fixed, but when the full number is on the two generators will be worked, one of them being stopped during the hours of light load. The generators are fired with anthracite coal and the boiler with common boiler slack.

The whole installation, which is very complete in every detail, has been carried out under the supervision of Mr. W. Langdon, superintendent of the telegraph department of the Midland Railway Company, and is a fine example of a modern electric light plant, in conjunction with gas engines and producer gas.—The Engineer, London.



GAS ENGINES FOR ELECTRIC LIGHTING PLANT.

Misfortunes of Birds.

I have noticed in a New York paper an account of a strange misfortune that happened to an English sparrow at the building of the Edison laboratory, Orange, N. J. The bird became entangled in a twine used in the construction of its nest, and met its death by hanging. This has reminded me of a similar incident that occurred to a bird last summer, near Bowling Green, Ky. It was a common or crow blackbird, and was seen hanging by the neck from the limb of a tall tree overhanging the road. Whether in flying with a long grass or string it became entangled with it or in what way it got caught in the noose and met its death, is a matter of conjecture. A queer incident of a woodpecker has come under my notice. The bird, a hairy woodpecker, was seen on a tree trunk, and though a stone was thrown toward it to see it fly, it remained in the same position. On going nearer, it was found that the bill had been driven into the tree with such force that the bird could not extricate it, and had hung there, meeting a miserable death.

I have heard from a friend of an interesting life history of a mocking bird. It was quite a young bird when purchased from a negro bird catcher, and it was soon discovered to have sore feet. These were swollen twice the natural size, and though efforts were made to relieve this, it was only after it had lost several of its toes—two front toes on one foot and one on the other—that the feet were finally healed. After this it moulted, losing about all its feathers at one time. Its eyes then became inflamed, and the eyeballs like drops of water, finally closed and the bird became totally blind. In getting its food it would stand at one side of the cage and follow the wires till it reached the food, it would then follow the side of the cage till it reached the water. It soon learned, however, to gage distances, and would fly to the perch without fail. It was a pitiable object, but strange to say, this poor maimed bird, lame and blind, developed into one of the finest of singers!—Sadie F. Price in Amer. Naturalist.

Bordeaux Mixture.

W. T. Swingle (Jour. of Mycology) states that copper sulphate may be dissolved with steam; the stock solution should contain two pounds of copper sulphate to a gallon. The color of the mixture should be deep sky blue. The clear liquid after settling gives no brown color with potassium ferrocyanide solution, but does give a slight precipitate of light bluish color with copper sulphate solution. The addition of soap to the finished mixture greatly increases its wetting properties and adds to its value for all plants with waxy coating on the parts sprayed.

THE skeleton alone of an average whale weighs twenty-five tons.

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Correspondence.

Irrigation by Wind.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of May 18 is an alleged discussion of "Irrigation by Wind." The writer takes the bicycle as an illustration, and traces its growth from its crudest forms through forty-six years to its present marvelous perfection—the most perfect, from a mechanical point of view, of any machine now in existence, not even excepting the watch, because the bicycle has more scientifically and perfectly constructed bearings than the watch. The writer then tumbles from this exalted height to the "Jumbo" windmill and lauds it for its "ease of construction, economy of cost, capacity in power," etc., none of which qualities does it possess.

In the first place, the "Jumbo," 21 feet in diameter and 27 feet long, with eight fans alluded to, will require 2,264 feet of lumber for the shield up to its shaft. This makes no mention of the frame on which the lumber is to be nailed and which carries the wheel, and which would doubtless bring it up to 4,000 feet of lumber. As a moment's reflection will show, of the eight fans described, but a quarter of them, or two, will be exposed to the wind at any one time, and of those two you really get no benefit except from one of them, for either one shields the other or else both stand so obliquely to the wind that not more than half efficiency is attained. You are, therefore, reduced to one-eighth of the sail surface. This one-eighth, by reason of the fact that it faces in one of two directions, is reduced to one-half of its efficiency again, leaving the sail surface with an efficiency of only one-sixteenth. Now add to this the further fact that it is not practical to get these wheels up where they get a good wind exposure, and the efficiency is reduced to almost nothing, which is found to be the case in practice.

A wheel needs to be at least 30 or 40 feet above the ground even in a level country to get good results, and in these prairie countries where irrigating is now being done, numerous groves are being planted, and the efficiency of the wheel that must be placed on the ground is very small and very little figuring will show that its cost is very large as compared with the marvelously efficient steel wheels now made. So far from the "Jumbo" being the germ of a new idea, it is a very old form that, together with a similar wheel with a vertical shaft, which is much better, were among the first of wind wheels and the most frequently reinvented and the most easily demonstrated to be utterly worthless.

A modern steel wheel, on a 40 foot steel tower that will pump more water in a year than this "Jumbo" described, can be bought at one-fifth its cost, and the pump for the steel wheel, since it works constantly when the wind blows instead of only a small portion of the time, is proportionately smaller and proportionately less costly. L. W. NOYES.

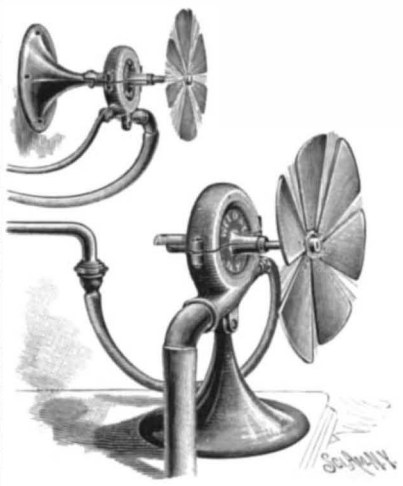
Breaking of the Earth's Crust.

From the point of view of the general geographer, whose scope takes in not only the superficial aspects of a country, but its physical construction as well, perhaps the most interesting contribution to African knowledge that has been made within late years is the demonstration by Dr. J. W. Gregory, of the British Museum, that there exists in Eastern Africa, occupying a very considerable portion of its extent, a narrow, and in places a very deep, trough, in which the great lakes and many of their tributaries are located, and which, with a more or less open and depressed lowland, communicates with the basin of the Red Sea, and yet further with the Dead Sea and to the Valley of the Jordan. To use Dr. Gregory's own words: "From Lebanon, then almost to the Cape, there runs a deep and comparatively narrow valley, margined by almost vertical sides, and occupied either by the sea, by salt steppes and old lake basins, and by a series of over twenty lakes, of which only one has an outlet to the sea. This is a condition of things absolutely unlike anything on the surface of the earth." The presence of such a rift, for rift it appears to be, can only be compared with the long lunar rifts which have so long puzzled astronomers. To Professor Suess, the eminent geologist of Vienna, we owe, indeed, the first demonstration that over large areas of the earth's surface the crust has been steadily breaking through in the direction of the earth's center, and that the crust has been torn and rifted throughout all time by the subsidences of earth blocks; and he truly, many years ago, pointed out the probable existence of this vast Afro-Asiatic trough, the evidence to which has now been supplied by Dr. Gregory.

This investigator was actually able to trace a long parallel-sided and steeply-walled valley, of perhaps twenty to twenty-five miles wide, extending southward from the Great Nyanza to beyond the first parallel of south latitude, or over a linear distance of some 150 miles or more. Over much of this extent the boundary walls are described as being "so precipitous that not even the most expert of cragsmen could scale them;" sheer precipices are indicated with elevations of 800 and 1,000 feet. This remarkable structure of most unique development and extraordinary persistency must be regarded as one of the most interesting features of the earth's surface.—Prof. Angelo Heilprin.

SIMPLE AND EFFICIENT FANS.

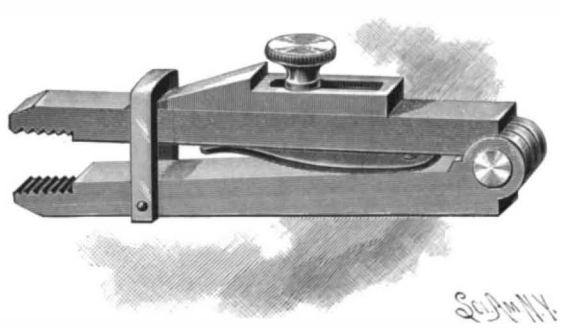
For ventilating or cooling sleeping rooms and other apartments, or for use in any situation where running water, at a pressure of twenty pounds or more, is available, the simple fan and connected motor herewith illustrated is designed to afford most efficient service, at a low first cost, and needing but the slightest possible attention afterward. The standard or base, as shown, may be fixed in a vertical or horizontal position, and the water connections may be satisfactorily made with hose where it is not desired to make permanent lead or iron pipe connections, the work being done by any one without the aid of a mechanic. This improvement has been introduced by Messrs. A. F. Weed & Company, 106 and 108 Liberty Street, New York, who originally designed the motor to operate a line of mechanical models requiring a light power. It has been found to be so well proportioned and so accurately adjusted that it runs at high speed without vibration and almost without wear, requiring no attention beyond an occasional oiling of the bearings, and has been adapted for all kinds of light machinery. Fittings are furnished for ready attachment to any style of basin cock, and, once installed, the device is always ready to operate by simply turning the faucet.



THE WEED WATER FAN MOTOR.

A NOVEL WRENCH.

In the wrench shown in the illustration the pivoted jaw arms are pressed apart by a spring, and one of the arms carries a pivoted holder or bail which extends over the other arm, limiting its outward movement, the jaws of the two arms being held in close gripping engagement with a nut, pipe, or other article by sliding a wedge along one arm and under the bail. The improvement has been patented by Mr. Alexander Delhommer, of Breaux Bridge, La. The wedge has a rearwardly extending shank in which is a longitudinal slot engaged by a screw screwing in the arm, and when this screw is loosened the wedge is free to slide along the arm, but when the jaws are brought into engagement with an article to be gripped, and the wedge is moved forward under the bail, the wedge is fastened in position by means of the screw, locking the gripping jaws upon the article.



DELHOMMER'S WRENCH.

The Clean Streets of Rome.

A correspondent of the New York Sun, in a recent letter from Rome, writes as follows:

I have been a good deal interested in observing the mode of cleaning the streets in Rome. They are kept so clean, even the poorest of them are kept so much cleaner than the best streets in New York, that I have given some time to the study of the system in force here and its expense. I have been kindly furnished by the officials of the city, on a request made through the consul-general, with answers to a series of questions which I framed in order to enable me to obtain accurate knowledge on the subject.

What the stranger sees of the process of street cleaning is that all over the city are men in a cheap uniform, armed with a broom of twigs, a basket, a shovel and a small red painted covered cart, very much as we see used by the men engaged in repairing the pavements with us, only smaller. Each obviously has allotted to him a certain portion of the street, and he is engaged all day in keeping it clean by sweeping up the dirt and putting it into his red cart. When he has no work of this kind to do he sits down on the edge of the sidewalk and proceeds, from a supply of twigs, to mend or make his broom. At stated periods in the day he wheels his cart off to a place of deposit, where its contents are emptied into large carts in waiting, which in turn carry the dirt out to places just outside the city gates.

There are two circumstances which render it easier to keep the streets clean at Rome than with us. One is the excellence of the pavement. A little more than one-half of the superficial area of the streets is macadamized, while the other half is chiefly paved with small trap rock blocks, almost identical with those brought from the Palisades and used with us. About one per cent of the superficial area is paved with asphalt, and a very small fraction with wood. But, however paved, the streets are kept smooth, so that there are no inequalities to retain dust.

The other circumstance which facilitates street cleaning here is that nothing is ever thrown into the streets from the houses or stores. No one seems to think of throwing any such matters into the street, for the reason in part that garbage and all the dirt and refuse that accumulate in the houses and stores are taken from them daily by men employed by the city, who ordinarily come into the houses and buildings and remove such refuse and carry it off in carts to places of deposit outside of the city. When the owners do not arrange to have the raccogletoli, as the collectors of garbage are called, come into the houses, they deliver it to them at fixed hours.

You will be astonished at the absurdly small figure which it costs to keep clean and sweet the streets of Rome, a city of 500,000 inhabitants. The following are the official figures, which include not only the expense of sweeping the streets and removing the sweepings to the places of deposit outside the city, but also the like removal of the garbage and house dirt and the watering of the streets. The horses and carts belong to the city, it having been found that the work was done more cheaply and better in that way than by contract, though ordinarily the contract system prevails for similar public work—such for instance as the collection of the octroi—much more generally than with us. A small charge, averaging only six cents a month, is made for the removal of garbage from each house, where the owners elect, as they almost universally do, to have the collectors come into the houses for that purpose. The sweepings are taken away from the several places of deposit outside the city walls by the peasants, who are glad to come and get the stuff.

If we reckon the dollar at five francs, the total expenditure in 1894 for all the service I have specified was $148,461, but from that must be deducted $31,428 received from various sources, including about $29,200 for the removal of garbage from houses, so that the net expense was only $117,033.

With reference to the length of streets swept there are in all about 180 miles, of which all except eighteen are swept daily. Each street is not only swept in the daytime, as I have described, but also specially each night. As to the superficial area there are about 2,956,000 square yards of street and 332,000 of sidewalk, making a total superficial of 3,286,000 square yards for the city.

There are employed in the performance of the work I have specified about 813 persons of all grades. Of these, 453 are the sweepers, 42 the cart drivers who carry away the street sweepings, 58 the cart drivers who carry away the garbage and refuse of houses and stables, and 129 the men who enter the houses and carry out the garbage from them. There is one superintendent, who has twelve clerks and as many assistants. Hostlers, farriers, harness makers, watchmen, etc., make up the balance. The total number of 813 is sometimes increased by men for a special service to 853.

The amount of street surface assigned to each sweeper varies with its width, its locality and importance, and with the mode of pavement. In the streets that are macadamized it is a maximum of about 30,000 square feet, while in those that are paved it is in some cases as low as 12,000 square feet. The average for the city is about 20,000 square feet to the sweeper.

The surprise which the small aggregate expense will excite will be much diminished when we come to know the wages that are paid. The street sweepers get, if we reckon the franc at 20 cents, 36 cents a day, and are entitled to a summer and winter suit of clothes and to two hats and two pair of shoes a year; but the total expense of these for the whole 453 sweepers is only $2,680 a year. The highest salary paid is $850 a year, to the superintendent, and there are only thirteen persons who receive annual salaries, some of them getting only $216 a year. The cartmen get from 45 to 50 cents a day. Those who deal with house garbage get from the city 25 cents a day, but are allowed to have some pickings from the matter removed. The highest wages paid to any employes is to the foremen, $1.25 a day. The mechanics get 50 to 60 cents and harness makers 50 to 80 cents.

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Safeguards Against Deterioration of Drug Stock.

A recent number of the Bulletin of Pharmacy contains an interesting article on this subject by Leon C. Fink, from which we abstract the following:

A large proportion of the materials which constitute the stock of an average drug store are particularly prone to deterioration, and painstaking pharmacists are required to exercise more than ordinary circumspection to prevent exposure of sensitive pharmaceuticals to pernicious influences. In fact, the art of affording such protection is quite as important as the ability to select drugs and prepare medicines properly.

A complete tabulation of all the chemical and physical changes which can modify and injure pharmaceutical preparations is not within the scope of this article, but it is deemed apposite to mention a few exemplary forms of deterioration which will serve to suggest to the minds of intelligent pharmacists others which can occur from similar causes.

The importance of maintaining a uniform temperature through day and night, in a pharmacy, is apt to be overlooked. Remember that your stock is largely made up of fluid preparations holding chemical substances in solution. These are reasonably permanent at a normal temperature, but, as the temperature lowers, the solvent power of the menstruum is reduced and precipitation of the less soluble ingredients occurs. Results grow gradually worse as the temperature goes down, until disaster comes in the freezing of aqueous solutions and consequent bursting of bottles.

Change of temperature may also cause loss and annoyance from breakage of demijohns through expansion or contraction of liquid contents. If a demijohn is filled with cold liquid, tightly corked, and subsequently transferred to a warm room or climate, the liquid will expand with rise of temperature and blow out the cork or burst the vessel. Tightly corked demijohns filled with hot liquids frequently collapse under atmospheric pressure as the contents cool and contract. It is therefore a safe rule never to fill such large glass containers completely, but rather leave an ample cushion of air to allow for expansion and contraction.

Sunlight can do incalculable damage to chemicals, pharmaceuticals, plush goods, and toilet articles in general, unless special precautions are taken to prevent its injurious action. Calomel is not altered by the atmosphere if kept in the dark, but when exposed to sunlight it gradually turns gray or black, indicating decomposition. Santonin acquires a yellow color by exposure to sunlight. Silver nitrate becomes gray or black on exposure to sunlight in the presence of organic matter. Sunlight darkens yellow mercurous iodide and yellow mercuric oxide in consequence of their partial reduction. Bright green scales of soluble ferric phosphate and soluble ferric pyrophosphate turn dark on exposure to sunlight. Red mercuric iodide is permanent in the air if kept in the dark, but acquires a brownish tint by exposure to sunlight. Quinine bisulphate readily acquires a deep brown-red color on exposure to direct rays of sunlight. Quinine sulphate and quinine hydrochlorate are gradually colored yellow by similar exposure. Ferric salts in solution with sugar are reduced to ferrous salts by action of sunlight. Many volatile oils are injured by prolonged exposure to atmospheric oxygen and sunlight, while some are eventually rendered worthless and entirely unfit for use. Perfumes exposed to direct rays of sunlight rapidly degenerate and soon acquire a rank odor. It is apparent, therefore, that they should not be habitually presented in show windows.

Drugs and chemicals are frequently injured by absorbing moisture or carbonic acid, or both, from the atmosphere. Solids that absorb moisture from the air are called hygroscopic. Solids which absorb moisture from the air and become liquid, or dissolve therein, are called deliquescent. Crystalline substances which part with their water of crystallization on exposure to air, thereby losing their crystalline form, are called efflorescent.

On exposure to atmosphere, caustic soda absorbs water and is liquefied, subsequently solidifying and becoming efflorescent. This change is caused by the absorption of carbonic acid and the crystallization and efflorescence of the sodium carbonate thus formed. Potassa also deliquesces and absorbs carbonic acid under similar exposure. Chlorinated lime absorbs moisture and carbonic acid from damp atmosphere, with loss of valued properties and formation of a plastic mass; it should, therefore, be kept in a closely covered jar and stored in a cool, dry place.

Lime becomes "air slaked" by exposure to ordinary atmosphere, absorbing water and carbonic acid, and being converted into hydrate and carbonate of calcium. Carbonate of potassium is extremely deliquescent in humid air, forming a colorless or yellowish alkaline liquid of an oily appearance. Chloride of zinc, acetate of potassium, and chloride of calcium are also very deliquescent salts which require special protection.

Powdered extracts should be carefully protected from exposure to moist air, in small bottles with mouths wide enough to admit the blade of a spatula. Selected corks should be used, and the bottles should be kept in a cool place—never in a current of hot air from a stove or furnace.

It is particularly essential that granular effervescent salts be kept in securely corked bottles, for if access of air be permitted, sufficient moisture will soon be absorbed to cause the acid to act upon the carbonated base and gradually liberate carbonic acid. The valued effervescent properties of the preparations will thus be irretrievably lost.

If clear lime water be exposed to the influence of air, a pellicle of calcium carbonate is formed upon the surface; this film sinks to make room for another, until finally nearly all the lime is rendered insoluble and the supernatant liquid is comparatively valueless. It is essential, therefore, that a goodly excess of lime be kept in the bottom of the lime water bottle to maintain the strength of the solution. The container should be kept in a cool place, as cold water dissolves more lime than hot water.

Solution of lead subacetate is decomposed on exposure to air or on being mixed with water containing air in solution, white precipitate of insoluble carbonate of lead being formed. When freshly made, it should be divided into two or four ounce bottles, kept full and tightly sealed until required for use. Liquor potassa and liquor soda also possess marked affinity for carbonic acid, and should be preserved in securely stoppered bottles.

Quinine sulphate, like some other alkaloidal salts, does not "lose strength" by exposure to ordinary dry atmosphere, but rather loses water of crystallization by evaporation and becomes correspondingly richer in quinine. It should be borne in mind also that effloresced carbonate of sodium is stronger than the normal crystallized salt in proportion to the amount of water it has lost. Sulphate of soda, commonly called Glauber salt, contains more than half its weight of water of crystallization, nearly all of which is dissipated on exposure to dry atmosphere, leaving a dry, white powder which is a correspondingly richer salt. Sulphate of zinc also effloresces slowly in dry air.

Atmospheric oxygen causes many undesirable changes in chemicals and pharmaceuticals. On exposure to air the color of sirup iodide of iron slowly changes to yellow and subsequently to brown, the change of color proceeding from the exposed surface downward. This color can sometimes be bleached and the sirup restored to its original appearance, but here is a case where an ounce of prevention is worth a pound of cure—keep the sirup in small bottles, full and well corked. Sirup bromide of iron is of course similarly affected.

Certain fixed oils will remain unchanged for a great length of time in air-tight vessels, but when exposed to the atmosphere they attract oxygen and ultimately become concrete. The tendency of linseed oil to dry or harden on exposure to air is typical in the extreme. Exposed to the air, lard absorbs oxygen and becomes rancid; it should, therefore, be kept in well closed vessels, or procured fresh when required for use. In the rancid state it irritates the skin, and sometimes exercises an injurious reaction upon substances mixed with it.

Phosphorus absorbs oxygen from the atmosphere with sufficient avidity to cause rapid combustion and necessitate its preservation under water. Prolonged exposure to air gradually transforms light green ferrous carbonate into the familiar red-brown "subcarbonate of iron," which is ultimately little more than ferric oxide and can undergo no further change from similar influences.

Not content with ravaging the pharmacist's stock, this belligerent element exhibits a remarkable propensity, in the presence of moisture, for rusting his spatulas and other metallic utensils.

Serious pecuniary loss by evaporation of volatile solids like camphor results from exposure of these substances in ordinary open wooden drawers. Menthol is extremely volatile, and should therefore be kept in securely corked bottles to prevent loss. Exposed to the air, carbonate of ammonium partially volatilizes, becomes opaque, and crumbles into a white powder. Iodine is most advantageously kept in securely closed glass receptacles—most ordinary wares are liable to be attacked or permeated by it. Chloral evaporates slowly when exposed to dry atmosphere. Powdered drugs which depend upon volatile constituents for medicinal virtue, like cinnamon, cloves, orris root, and valerian, should, so far as practicable, be kept in bottles or some other comparatively air-tight container.

Stronger water of ammonia should be kept in strong, glass-stoppered bottles, which should be stored in a cool place and opened with extreme care. When warm, the liberated gas frequently forces the stopper out with considerable violence, and many accidents resulting in injury to the sight of operators are on record.

Pressed roots and herbs are more convenient to handle, occupy less space, and are better preserved than crude drugs in bulk form. Furthermore, the danger of error is materially reduced by handling neatly pressed, wrapped, and labeled packages.

Examine your stock of dandelion and rhubarb roots occasionally to be sure that purchasers do not find worms in them and form unfavorable impressions of you and your business methods.

Cantharides should be thoroughly dried and kept in securely closed containers. The vapor of chloroform quickly kills insects which infest cantharides, and their destruction can be accomplished by placing a small quantity of chloroform in a wide mouth bottle or other open vessel upon the surface of the infested drug and securely closing the container. The heavy chloroform vapor will then gradually sink through the drug and destroy the insects.

The modern method of marketing chlorinated lime in hermetically sealed parcels is not only a source of convenience, but affords protection which serves to prevent loss of the loosely combined chlorine, upon which the value of the preparation as a disinfectant is almost entirely dependent. The disagreeable odor of chlorine which clings to the hands of the operator is also avoided.

Charcoal is used in medicine chiefly for its absorbent and disinfectant properties. Owing to its absorbent powers, it should not be unnecessarily exposed to the atmosphere of a laboratory or pharmacy, lest it be thus rendered unfit for medicinal purposes.

Fine sponges should be kept in a closed showcase or drawer. Carriage and slate sponges, which are frequently allowed to become soiled and lend an untidy appearance to the store by rolling about in a window or on the floor, can be conveniently kept assorted and conspicuously displayed in the wire basket with separate compartments for different sizes.

Oxalic acid should not be kept in paper parcels, since it soon renders the paper fragile, and in being thus scattered about may, by admixture with other drugs, cause loss of life. Owing to its external resemblance to Epsom salt, and its very poisonous nature, the substances should not be kept in similar drawers. The practice of keeping them in containers of different style and safely remote from each other is less likely to lead to accidental confusion.

Remember that heated atmosphere usually accumulates near the ceiling, and preparations subject to injury by exposure to elevated temperature should not be kept on upper shelves. Several cases are on record wherein chlorinated lime, which is known to greedily absorb water and carbonic acid from a humid atmosphere, was put up in securely corked and sealed bottles, which were then placed upon an upper shelf until the heat of summer, or a very warm apartment, had liberated sufficient gas to cause a startling explosion, sometimes followed rapidly by a succession of similar ones and a cloud of dust.

Lard, ointments, cerates, and, in fact, nearly all animal fats, are liable to grow rancid by prolonged exposure to air, this change in many cases being accelerated by heat and light. Every precaution should, of course, be taken to avoid such decomposition; but when rancidity is apparent, preparations should never be dispensed, for, instead of having the mild demulcent properties which constitute their chief value, they become irritant and entirely unfit to serve as vehicles for medicinal substances to be applied to the skin. Ointment jars should invariably be thoroughly cleaned and freed from rancidity before refilling with fresh stock.

With ordinary drug store arrangement it is scarcely practicable to entirely protect tinctures and fluid extracts from injurious effects of air, light, and changes of temperature, but any provision which tends to prevent precipitation from these causes is commendable. The stock of tinctures should be placed in charge of one capable employe, who should be held responsible for its condition. Haste is apt to make serious inroads upon accuracy in preparing pharmaceuticals.

The danger from leaving bottles insecurely corked is apparent when we consider that if a fluid extract prepared from a menstruum composed of diluted alcohol be exposed to the air in an open vessel, the alcohol will evaporate much more rapidly than the water. By this change of character in the menstruum certain resinous constituents of the drug frequently become insoluble and are deposited, rendering the fluid more or less turbid, and materially lessening its medicinal value. Collodion loses ether by evaporation, and becomes comparatively worthless.

The deterioration which can occur in a single drug store from causes indicated here commands the constant attention of the manager, and much greater is the problem which confronts the wholesale manufacturer, who must prepare a great variety of products in large quantities to be distributed in the market in all directions, where they are expected to remain unchanged through the extreme variations in temperature which characterize the severe winters in the north and the torrid summers in the south; and no less injurious is the improper exposure to which pharmaceuticals are frequently subjected in temperate climates.

IT is stated that Dr. Bertillon has discovered a new method for identifying handwriting by enlarging the letters by photography and measuring the alterations due to beating of the pulse.

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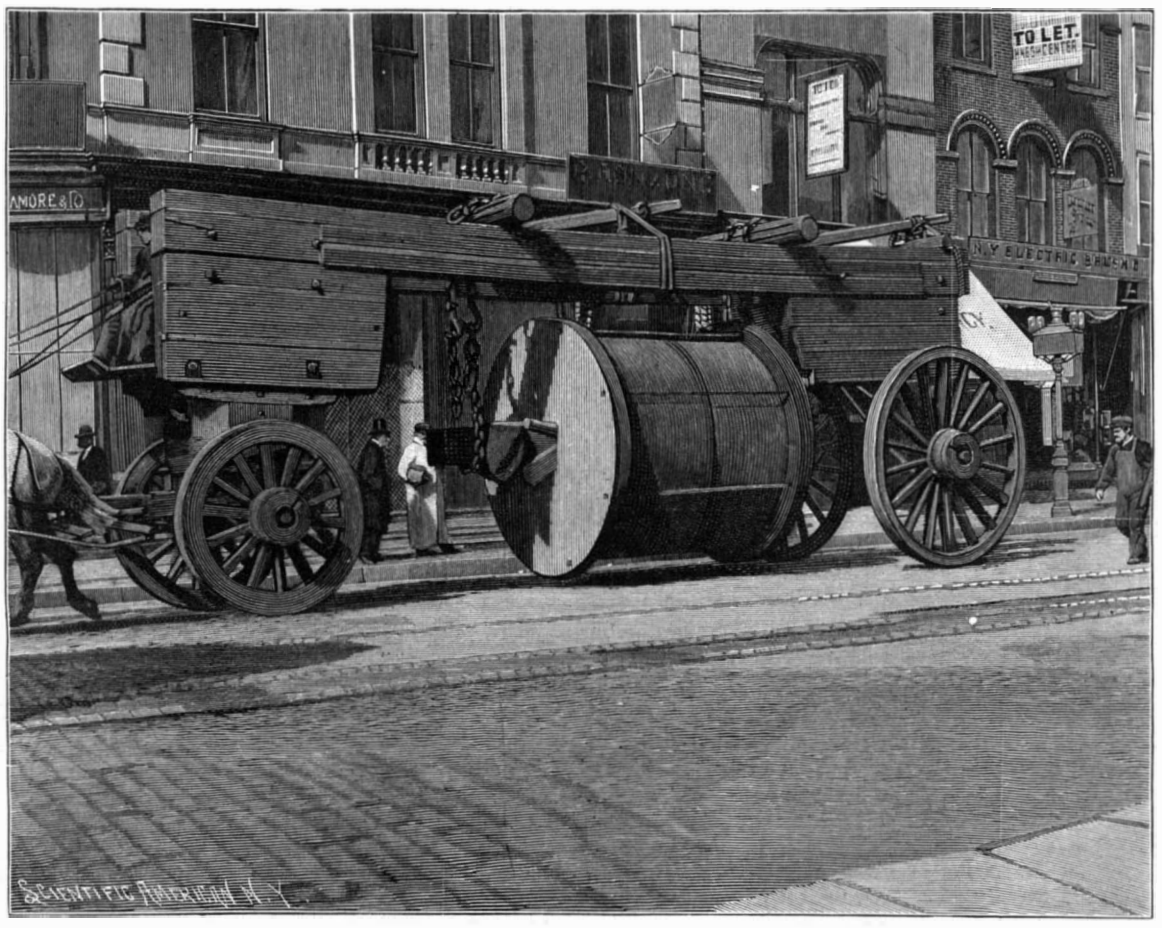
THE TRANSPORTATION OF LARGE CABLES.

The cable system of propelling cars has found favor in New York City, and the Third Avenue, the Broadway, the Columbus Avenue and the Harlem cable railways are in operation and the Lexington Avenue railway will soon be ready. The cables come to the power house either entire or in sections in big spools weighing from 40 to 50 tons. The spools are transported by means of gigantic trucks, drawn by long strings of horses; in some cases twenty horses are attached to the truck. We give illustrations, one of which is a near view of truck and cable spool; the other engraving shows the procession of horses employed in drawing the truck. Our engravings were prepared from photographs kindly supplied to us by Mr. A. Montant, of this city, who is a skilled amateur photographer.

When the spools have reached the power house, they are hung on trunnions and the cable is then run into the slotted tube that extends through the street. This is usually done by means of a platform car weighted with iron as heretofore illustrated in the SCIENTIFIC AMERICAN.

The cables on the Broadway road are one and one-half inches in diameter. They have a manila center. Around this and pressed closely into it are six strands each made of nineteen steel wires. After the cable has been threaded into the slotted tube, or conduit, and spliced, it is treated with wood tar and this coating is renewed from time to time. The cable is lubricated with linseed oil to render it easy to slide through the grips and around the curves. A cable for the Broadway road costs about $15,000 and wears very unevenly. The life of a cable varies greatly, but in general it is from 65,000 to 90,000 miles. On the Brooklyn Bridge a cable has lasted for 1,140 days, which is far above the average, which is 500 days.



TRUCK FOR CARRYING A CABLE SPOOL.

Fast Railway Speed.

According to the Railroad Gazette, the time made April 21 last, by the newspaper train from Camden, N. J., to Atlantic City, 58·3 miles, was 45¾ minutes, being an average rate of 76·46 miles per hour.

The train consisted of one combined passenger and baggage car, No. 5,116, and locomotive No. 1,658. It left Camden at 5:35¾ A. M. and arrived at Atlantic City at 6:21½ A. M.; running time 45¾ minutes. From Liberty Park to Absecon, 49·8 miles, the running time was 37½ minutes and average speed 79·7 miles an hour; from Berlin to Absecon, 35·6 miles, running time 25¾ minutes, average speed 82·9 miles an hour; from Winslow Junction to Absecon, 24·9 miles, running time 16 minutes, average speed 83 miles an hour. The fastest mile was made in 41 seconds, equivalent to a speed of 87·8 miles per hour. This was near Absecon, on a grade falling 10 feet per mile, following a short stretch of level track.

The engine is of the American type, 4 driving wheels coupled, 78 inches in diameter. The cylinders are 19 inches by 24 inches, and the weight of the engine in working order is 122,600 pounds, with about 87,000 pounds on drivers. It burns bituminous coal and the boiler carries a steam pressure of 175 pounds per square inch. The size of the grate is 33·25 square feet and the heating surface is 1,583 square feet.

American Art Products in Germany.

Commercial Agent Louis Stern writes from Bamberg to the State Department as follows: "It is well known that, on the occasion of the Columbian World's Fair, a number of specimen productions of American art and skill in fashioning the precious metals on exhibition there were purchased at the instance of the Industrial Art Museum, of Berlin. This collection, consisting of forty-seven ornamental art pieces and decorative table vessels produced for the most part by the establishments of Tiffany & Company, the Whiting Manufacturing Company, and the Gorham Manufacturing Company, is now being publicly exhibited in those German industrial cities which represent the same branch of industry. In this connection, therefore, it will undoubtedly prove a source of great satisfaction to the business and other circles interested in the United States to learn that these American works of art are meeting with most cordial encomiums on the part of German expert judges. At the present time, the collection mentioned is on exhibition at the Royal Drawing Academy of the city of Hanau, one of the leading places representative of the German gold and silver ware industry. The local papers devote long articles to praising the small exhibit, calling particular attention to the fact that these American products are not only effective by reason of the charm of novelty, but that they also afford instructive study as regards form and technical development.

"I close this short report with the translation of the critical judgment rendered by a German expert in the branch of industry in question, recently published in the Hanauer Zeitung. He writes:

"On the whole, from a technical standpoint, one must concede the solidity, dexterity, and neatness of execution displayed by these pieces. The principles of art followed by the Americans, as demonstrated by this collection, are difficult to properly characterize. Numberless suggestions, furnished by European art forms, Oriental influence, naturalism, practical American sense of fitness, and a little American primitiveness, also, are combined in the most remarkable manner. The great art traditions which guide European schools of art and elevate their standards of taste are obviously lacking with the Americans; but on the other hand, these traditions do not, as with us occasionally, act as an immovable interference; the American artists manipulate art forms in an entirely free and unhindered manner. The further circumstance that, in the large establishments of American firms, artisans from all the countries of Europe and Asia are employed, each giving the impress of his own particular schooling to the work of art produced, must also be taken into consideration. The natural result is that American productions show something of the peculiar, the novel, and the surprising.

"Many of the effects attained are bizarre, it is true, but then there is much that is original, of inventive ingenuity, and worthy of study. It is our opinion that, without any doubt, many fruitful suggestions can be gained from these works, especially as regards technical execution. The novel technical process consisting in the galvanic coating of pottery and glass vessels should be adopted with advantage by our branch of this industry. The effort to increase the color effect of silverware by employing stone decorations, enameling, etching, and vari-colored gilding is likewise worthy of general imitation.

"The great republic across the sea has added to its progressiveness in all other respects an advance in the dexterous manipulation of the precious metals which should not be undervalued by us in Germany."

HORSES DRAWING THE CABLE SPOOL.

Prune Rust.

The prune and other drupaceous fruits are frequently seriously injured by Puccinia pruni. It is most destructive to the prune in California, but also occurs on the peach, plum, cherry, nectarine, apricot, and almond. Mr. Newton B. Pierce finds that this disease can be held in check by spraying with ammoniacal carbonate of copper, or modified eau celeste; as the fungus is endophytic, treatment must be preventive. The fact is to be noted that the dry summers of California allow the spray to remain on the foliage until the fall rains.—Jour. Mycology.

THE celebrated Villino Ludovisi, in Rome, has been leased for the new American School of Architecture and Archæology.

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THE STAINED GLASS WINDOW INDUSTRY.

There are few arts combining both the useful and ornamental that add so much to the gratification of the public as the introduction of stained glass windows in edifices, whether public or private. To so temper the glare of light passing through an opening in the wall, and render it a source of pleasure to the eye, by means of harmonious colors, is the study of the stained glass window producers.

In church edifices, this use of colors in windows has now become quite general, and to meet the æsthetic demand, glassmakers and artists are taxed in devising new shades and designs to meet the local or sentimental tastes.

For design, it is quite natural that the great field of Scripture should furnish an endless variety of central subjects, while a framing may be composed by a harmony of flower, leaf, and scroll.

In arranging a window the artist is first governed by the cost of the materials and the sum allowed for the finished work. That being stated, he arranges the sash space into the most beautiful and appropriate design that the pecuniary limit will allow. The design is first arranged on a small water colored sketch, then enlarged to full size by pencil outline on heavy manila paper. Each of the parts of the design are now cut out by use of double shears, shown in the illustration. These shears are made double for the purpose of cutting away as much of the paper on the line as will compensate for the thickness of the leads that join all the various pieces together. A simple design is shown above the shears, cut into its parts and a tack through each to keep them in place on a board, and from which they are removed to lay upon the glass, while a diamond or wheel follows their edge as a guide in cutting. There are five different sizes of leads used, shown in cut, the height being the same, but of varying widths of face presented; the double shear concerns, of course, only the upright, standard portion of the lead.

At this point, the taste of the artist is further supplemented by the skill and eye of the glass selecter. From a profusion of colored glasses, with surfaces of smooth or roughened texture as required, he selects the quality and color he thinks most effective for the location. This he writes upon each piece of the design and then they are given over to the glass cutter.

The glasses most used are prime colors—ruby, blue, amber, purple, and green. In addition to these are plain hammered cathedral (all shades), antique, variegated cathedral of two or more shades, blended brown and amber, brown and blue, brown and pink, olive and amber, imported Venetian, American Venetian, ondoyant, and, the most useful of all, opalescent glass. Most of these varieties are made in this country and are prized for their clearness. The surfaces are in all designs and degrees of coruscation.

If the window is to have figures included in the design, or portions that require special treatment, then the work, such as portraits, hands, feet, animals, etc., is painted with metallic colors on plain glass and "burned in," in a gasoline heated muffle furnace, shown in lower left corner of cut. This requires great skill and management in gradual raising of the temperature to the flowing point, and final slow cooling. Even with the greatest care, fine bits of painting are sometimes cracked and ruined in the furnace, necessitating a repetition of the work.

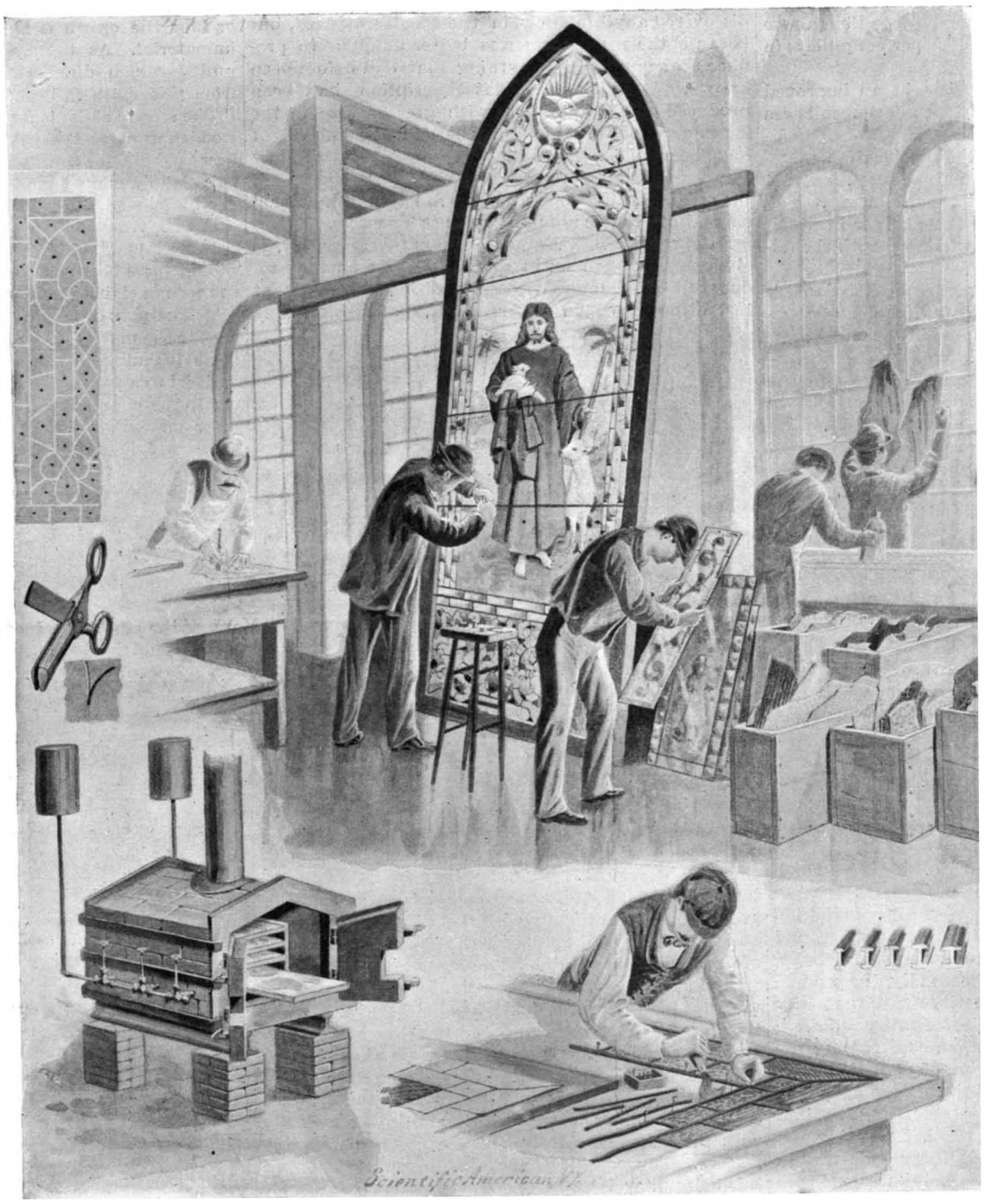
Having all the various pieces of glass prepared and laid upon their corresponding part of the paper design, the board upon which they rest is removed to a large table, where, in a square corner of the table, two pieces of the lead are mitered and placed against the right angle sides of the elevated edges. The first corner piece is placed in the groove of the lead, a short piece is cut the length for the lower edge and another for the angle end and side. The workman is provided with a hook shaped knife, as shown in the lower right corner of cut, with which he easily cuts the soft leads, while the weighted opposite end of the knife handle serves as a tamping hammer.

A second piece then follows in its place and is similarly surrounded with the grooved leads; curved edges are readily placed by the very plastic lead. Occasional measurements are taken, and with a soft wood guard the work is tamped up to reduce any enlargement of work, by crooks in the intervening leads.

When the pieces are all in their appropriate places, the workman goes over every joining of the leads with a soldering iron and solder, thus fastening the whole together. This necessarily must be done with both sides. To make a window rainproof, the glass must be puttied in to the sash. The leads are made slightly deeper than the thickness of the glass, for this provision, and now the workman daubs thin putty over the whole glass, and with a handless broom he sweeps in every direction over the window and drives the putty into the spaces, finally cleaning off the surplus by a bath of sawdust and a vigorous brushing.

Nothing remains to do now but put the glass in the sash, set it up as shown, and wire it securely to thin cross bars for security from high winds, etc.

We are indebted to Chicago firms for information and sketches pertaining to this industry, and it is a pleasure to us to speak our gratification of the work done, both in an artistic and workmanlike manner, by Messrs. Geo. E. Androvette & Company, Flanagan & Biedenweg, and the Wells Art Glass Company, of Chicago. We are pleased to know that many churches, private residences, and places of trade are beautified with their products.



THE STAINED GLASS WINDOW INDUSTRY.

Bursting of an Old Fifteen Inch Gun.

A test of emmensite, the new high explosive, at the Sandy Hook proving ground on May 11, resulted in an explosion of the shell in the gun, which was shattered, some of the fragments being found a quarter of a mile away. According to Captain Frank Heath, who has been conducting a series of tests on emmensite, this test demonstrated that it cannot be fired in safety in large charges. Until the test on May 11, it has been successfully fired in shells from powder guns of medium caliber. The 7, 11, and 12 inch guns being used, the charges not exceeding thirty pounds. It was then determined to try an old 15 inch smooth bore gun which had been rifled. After testing the gun with large charges of gun cotton a steel shell was filled with 230 pounds of emmensite and the gun was loaded. Extraordinary precautions were used and the gun was fired by electricity. A terrific explosion followed when the firing key was touched, and the air was filled with flying bits of iron and sand. The gun carriage was torn to bits and scattered. A hole 10 feet deep and 25 feet in diameter was made in the ground. No one was injured.

The Electric Candle.

The electric candle is in great request in England for the lighting and decoration of dining and other tables. An ingenious device for lighting the candles is provided by placing small pads under the table cloth, and taking the current from them by means of two pin points in the base of the candlestick. The candles, of course, are extinguished on being taken from the table, and are relighted when they are replaced in the proper position. They are so arranged that the bulb and the glass imitation of a wax candle can be removed, when the candlestick can be used for an ordinary candle. When used with shades of colored silk, the electric candle makes one of the prettiest additions to a dinner table that it is possible to imagine.

The Protection of Iron and Steel by the Gesner System.

The Gesner method of protecting iron and steel from rusting is described in La Revue Scientifique. The principle of the process consists in forming on the surface of the metal treated a double carbide of hydrogen and iron, which is extremely hard and adhesive. In carrying out the process, the articles must first be thoroughly cleaned from rust; but it is not so essential that all oil or grease should be removed from their surfaces. The treatment is effected in a pair of gas retorts, set side by side, and raised to a temperature of from 600° to 700° C. The articles to be treated are placed in a retort for about twenty minutes, when a current of hydrogen is turned into the retort, and kept on for forty five minutes. Then a small quantity of naphtha is introduced; the supply being kept on for ten minutes. The naphtha is then shut off; a current of hydrogen being turned on for fifteen minutes longer, when the process is finished. All that remains is to cool the retorts down to 400° C; and as soon as this temperature is reached, the retort lids can be taken off and the product removed. The coating thus produced has a bluish color, and is stated to be so adherent to the metal that a treated bar can be bent through an angle of 45° without disturbing it. The thickness of the protective coating is not stated.

THE Boston Herald says: A Portland business man has hit on a new scheme for being awakened at the proper time in the morning, which he declares beats any alarm clock that ever was invented. He has his telephone in his bedroom, and each night when about to retire he calls up the central office and requests the operator to call him up at a designated hour, in order to find if the "phone" works properly. Promptly at that hour the bell rings loudly, and he is awakened with neatness and dispatch. He claims that the service thus rendered is alone worth the annual rental of the telephone.

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ABSTRACTS OF DECISIONS RELATING TO PATENTS.

Supreme Court of the United States.

RISDON IRON AND LOCOMOTIVE WORKS v. MEDART et al.

On appeal from the Circuit Court of the United States for the Northern District of California.

This was a suit in equity instituted by Philip and William Medart against the Ridson Iron and Locomotive Works, for the infringement of three letters patent granted to Philip Medart, viz.: Patent No. 248,599, dated October 25, 1881, for the manufacture of belt pulleys; patent No. 248,598, also dated October 25, 1881, for a belt pulley; and patent No. 238,702, granted March 8, 1881, also for a belt pulley.

In the first patent, No. 248,599, the patentee stated in his specification that his invention "relates to that class of belt pulleys formed of a wrought metal rim and a separate center, usually a spider, and usually made of cast metal.

"Heretofore considerable difficulty has been encountered in the manufacture of such pulleys, much time, skilled labor, and large and elaborate machinery have been required, and their production has been correspondingly expensive.

"The object of my invention is to cheapen and simplify their construction, overcome the objections above mentioned, and produce strong and perfect pulleys in a quick and efficient manner.

"My invention therefore consists in an improved process of manufacture, whereby the above results are obtained."

The drawings accompanying the specification represent the machinery for carrying out the invention, and the pulley at various stages of its manufacture. The specification sets forth in detail the manner in which the machinery is operated, and winds up with the following statement:

"Pulleys thus manufactured are perfectly balanced, faultless in shape, strong and durable, and can be produced more rapidly and at less expense than the imperfect pulleys heretofore made.

"The machinery herein shown and referred to has not been described more in detail, as its operation will be clear to those skilled in such matters; and no claim to it is herein made, it being my purpose to secure protection for such apparatus by other applications hereafter to be made."

The claims, which are four in number, are all for the described improvement in the art of manufacturing belt pulleys, which consists in centering the pulley center or spider and then grinding the same concentrically with the axis of the pulley, the several claims stating with more or less detail the principal steps in the manufacture.

In his specification to patent No. 248,598 the patentee states that his "improved pulley belongs to that class of pulleys composed of a separate spider, usually of cast metal, and a wrought metal rim, which is secured to the spider;" and that his invention "consists in a pulley which is perfectly true and accurately balanced, that is, a pulley in which the center of gravity and geometrical center or axis coincide."

In his specification to patent No. 238,702, which was granted about seven months before the other patents, the patentee states that his invention "relates to certain improvements in belt pulleys, and has for its object, first, the production of a cheap, light, and durable pulley; and, secondly, the production of irregular sizes of pulleys without the necessity of a separate pattern for each size of pulley required; and this invention consists, first, in constructing the usual crown or dish on the rim of wrought metal rimmed pulleys by bending said rim transversely during the process of manufacture; secondly, the belt pulley having arms formed of wood, preferably of a cylindrical shape, which at their inner ends rest in sockets cast on the hub, and at their outer ends are provided with bracket lugs, to which the pin is secured by rivets or other equivalent means."

Fig. 1 of the following drawings exhibits a perspective view and Fig. 2 a vertical section of the patented pulley.

The defendant appeared and demurred to the bill upon the ground that the patents did not show invention upon their faces. The demurrer was argued and overruled and leave given to answer, and upon a subsequent hearing upon pleadings and proofs it was adjudged that all of the patents were valid; that the defendant had infringed the first, second, and third claims of patent No. 248,599, the two claims of patent No. 248,598, and the first claim of patent No. 238,702, and defendant was enjoined from further infringing. A final decree was subsequently entered, upon the report of the master, for $1,811.25, from which decree the defendant appealed to the Supreme Court.

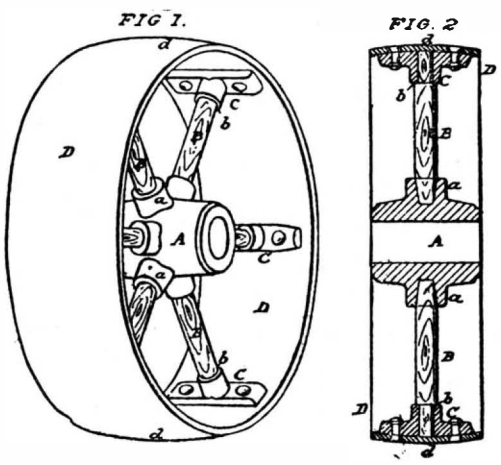
Mr. Justice Brown delivered the opinion of the court.

Patent No. 248,599 is for an improved process of manufacturing that class of belt pulleys formed of a wrought metal rim and a separate center, usually a spider, and usually made of cast metal.

It may be said in general that processes of manufacture which involve chemical or other similar elemental action are patentable, though mechanism may be necessary in the application or carrying out of such process, while those which consist solely in the operation of a machine are not. Most processes which have been held to be patentable require the aid of mechanism in their practical application, but where such mechanism is subsidiary to the chemical action, the fact that the patentee may be entitled to a patent upon his mechanism does not impair his right to a patent for the process; since he would lose the benefit of his real discovery, which might be applied in a dozen different ways, if he were not entitled to such patent. But, if the operation of his device be purely mechanical, no such considerations apply, since the function of the machine is entirely independent of any chemical or other similar action.

The patent in question clearly falls within this category. It is upon its face "for an improved process of manufacture," and mechanism is shown and described simply for the purpose of exhibiting its operation, which is described in detail. The result is a pulley more perfectly balanced, more faultless in shape, stronger and more durable, perhaps, than any before produced; but this was not because the patentee had discovered anything new in the result produced, but because the mechanism was better adapted to produce that result than anything that had before been known. As pulleys of that description had been produced before, doubtless with greater care in the manufacture of them, a pulley as perfect as his might have been made. So that all that he invented in fact was a machine for the more perfect manufacture of such pulleys. The operation or function of such machine, however, is not patentable as a process.

Patent No. 248,598, granted upon the same day, is obviously, though not in so many words, for the product of the mechanical process described in the patent just disposed of—in other words, for a belt pulley



made substantially in the manner detailed in that patent.

After detailing the advantages of having the pulleys perfectly balanced and shaped with absolute accuracy, and setting forth in general terms the manner of securing this by grinding the rim concentrically with the axis, he claims, first, "the improved belt pulley herein described, having the ends of the spider arms ground off concentrically with the axis of the pulley;" and second, the same pulley with the rim and the ends of the spider arm ground off concentrically.

Obviously the patent in question is not for a new device, nor for a new combination of old devices. It contains precisely the elements of every other belt pulley, and operates in substantially the same way. It is in reality a patent for a belt pulley which differs from other belt pulleys only in the fact that the rim and ends of the spider arms are ground off concentrically with the axis. Obviously this is not a patentable feature. The specification states in substance that this belt pulley is superior to every other because it is better made, more perfectly balanced, and is one in which the center of gravity and geometrical center, or axis, coincide. It is said that such perfection of balance can only be obtained by the process described in the prior patent, viz., by grinding off the ends of the spider arms; but it does not follow that some other person may not, by another process, or by greater care or superior skill or deftness in the handling of tools, manufacture a pulley which shall be equal to this. But if this patent be valid, he would be an infringer in so doing, though he employed no mechanism whatever in the manufacture of such pulley, and did the work entirely with his own hands, if only he ground off the ends of the spider arms.

In short, this is a patent only for superior workmanship, and within all the authorities is invalid. This court has repeatedly stated that all improvement is not invention. If a certain device differs from what precedes it only in superiority of finish, or in greater accuracy of detail, it is but the carrying forward of an old idea, and does not amount to invention. Thus, if it had been customary to make an article of unpolished metal, it does not involve invention to polish it. If a telescope had been made with a certain degree of power, it involves no invention to make one which differs from the other only in its having greater power. If boards had heretofore been planed by hand, a board better planed by machinery would not be patentable, although in all these cases the machinery itself may be patentable.

Patent No. 238,702, also for belt pulley, antedated the other patents by seven months.

The claims are as follows:

"1. A wrought metal rimmed pulley having a crown d, formed on its rim during the process of manufacture, as described, and for the purpose set forth.

"2. A belt pulley provided with wooden arms, B, a cast metal hub, A, having radial sockets a, and bracket lugs C, for the attachment of the rim, D, as described, and for the purpose set forth."

If, as stated in the specification, it had been "usual" heretofore to form the rim with a crown or dish, it makes no difference, so far as the completed article is concerned, whether it be formed during the process of manufacture by bending the rim transversely, or in any other way. Indeed, it is difficult to see how the crown could be made except during the process of manufacture, as it is part of such process. We are dealing with a belt pulley as a new article of manufacture, and the question how the pulley is made, or how the crown is made upon the rim, is entirely immaterial. As the first claim does not describe a pulley which differs at all in its completed state from prior pulleys, it is clearly invalid.

The second claim is for a belt pulley provided with wooden arms and a cast iron hub with sockets and bracket lugs, for the attachment of the rim. But as this claim was not found by the court below to have been infringed, it is not necessary to consider it.

For the reasons above given we think all these patents are invalid, and that the demurrer to the bill should have been sustained, except perhaps so far as the second claim of the last patent is concerned.

Medart may or may not have been entitled to a patent for the machinery employed in the manufacture of the belt pulleys in question; but he certainly was not entitled to a patent for the function of such machine, nor to the completed pulley, which differed from the prior ones only in its superior workmanship.

The decree of the court below must, therefore, be reversed, and the case remanded to the circuit court, with directions to dismiss the bill.

Specific Gravity and Weight of Wheat.

Mr. J. U. Lloyd read a paper before the American Pharmaceutical Association, 1894, in which he presents some figures on the grain weight and density. The average weights of wheat from the several principal wheat countries were:

	Grains.
Australia and New Zealand	71·895
England	71·108
India	66·765
South America	56·119
United States and Canada	51·541
Russia	47·795
Total average	60·670

Average weight from the heaviest sample of each country:

	Grains.
India	84·190
South America	77 890
Australia and New Zealand	77·878
England	77·378
United States and Canada	74·430
Russia	56·638
Total average	74·734

Australian and New Zealand wheats (three specimens) and some Bombay samples combine high weight and large size of grain with high density, ranking first in the list. These are followed by two samples from England, California choice, and last Chile, which has lowest density combined with large size and high weight. Most United States and Canada wheats belong to class of small size and low weight, but high density.

A New Thermo-Battery.

A further attempt to make a thermo-chemical galvanic cell has been described in the Comptes Rendus by M. Desire Korda, who worked with ordinary gas retort carbon. M. Korda finds that, if barium peroxide is heated to redness in contact with a carbon plate, the oxide becomes reduced to baryta, with the attendant phenomenon of a difference of electrical potential of about one volt, the carbon plate being negative. A similar result was obtained with cupric oxide, when a layer of potassium carbonate was placed between the oxide and the carbon; the difference of potential in this case amounting to 1·1 volts. In these experiments, the plate of retort carbon was connected by means of a platinum wire to one terminal of a Richard voltmeter; and a few cubic centimeters of the salt operated upon were placed on the carbon. A platinum wire dipping in the salt served to complete the circuit. The carbon was heated to a dull red in an atmospheric gas flame, when violent effervescence took place; carbonic acid being given off, and the voltmeter showing a deflection. This deflection of the needle remains constant as long as any of the higher oxide is left upon the carbon. The experiment is at any rate a simple one.

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FLYING CRUSTACEA.

Man is impelled by an irresistible desire to dominate space. Scarcely has he made sure of a motion of a desired velocity upon land and water than he thinks of conquering the atmosphere that surrounds him, and constructs apparatus of greater or less ingenuity for ascending above the planet trodden by his feet. May it not be the same instinct that has in all times led him to interest himself particularly in animals that fly, and especially in such of them as, by their primordial organization, are essentially terrestrial and aquatic beings? It is always the case that every new fact in this order of ideas very naturally excites in us a new feeling of curiosity.

Aside from birds and insects, there have, up to the present, been known several animals that, owing to a special arrangement of such or such a part of the body, are capable of flying, or at least of maintaining themselves in the air for a greater or less length of time. Such are the bats and the flying squirrels, among mammals, and the exocetes among fishes. Such beings belong to the vertebrate branch of the animal kingdom, but analogous facts have been very recently discovered among the invertebrates. The insects are no longer the sole arthropods that have the faculty of cleaving space and transporting themselves by aerial way. The same faculty has been observed in a crustacean—a very small one, which neither in size nor form recalls the crustaceans known to everybody, the lobster or the crab, for example.

The following are the facts in all their simplicity: Dr. Ostroumoff, a very distinguished scientist, director of the biological station of Sebastopol, made an excursion in a boat last summer along the coast of the Crimea. One morning, while the sea was very calm and the sky of an azure such as one sees only in southern countries, he observed clouds of small beings hovering like flies above the tranquil surface of the water. Approaching slightly, our naturalist was, as were his son and the boy who accompanied him, enabled to observe the phenomenon at leisure, and the following was what was ascertained: Each of these small animals in the first place took a proper position on the surface of the water, as if seeking to gather strength, and then made a leap and described in the air a long and gentle curve in order to fall back again into the liquid element. To collect a certain number of these beings and examine them with the lens was the work of a moment, and what was not the astonishment of the Russian naturalist when he recognized that the captive animals were crustaceans that are quite common in

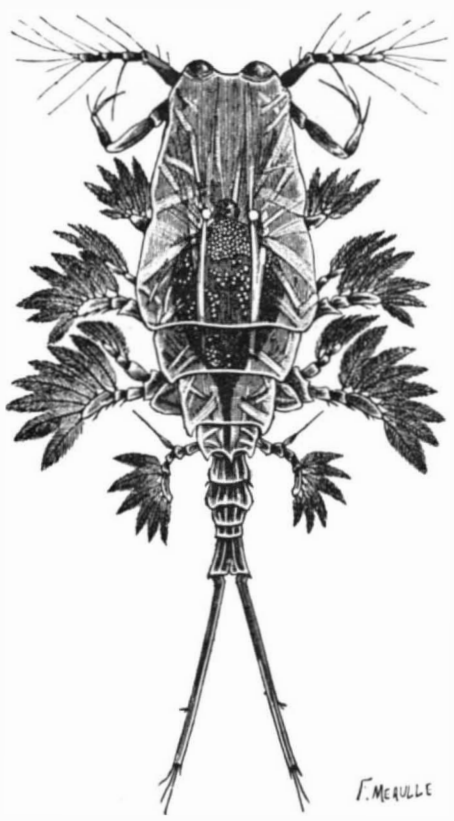

Fig. 2.—COPILIA VITREA, HAECKEL. (×20.)

the Black Sea, and that belong to the genus and species Pontellina Mediterranea (order Copepodeæ).

If we examine certain small crustacea under the microscope, we shall be much surprised at their odd aspect. We shall mention a few examples. The Calocalanus pavo, which is quite common in the Mediterranean, exhibits a transparent body, and, at the extremity of the abdomen, carries eight golden yellow symmetrically arranged feathers (Fig. 1).

Another crustacean of the order Copepodeæ has analogous but much more developed appendages; it is the Copilia vitrea (Fig. 2), an odd little animal, every leg of whose transparent body is provided with a rich fan of microscopic feathers of a brick red.

Finally, a species scarcely distinct from that observed by Mr. Ostroumoff is the Pontellina plumata (Fig. 3). Examined at an amplification of from 40 to 50 diameters, it presents a multitude of silken hairs that ornament its legs as well as the extremity of its abdomen, vulgarly called the "tail" in the crustaceans. These hairs, often arranged as feathers, contrast by their bright orange color with the blue body of the animal and its transparent limbs. There is no doubt that these numerous hairs singularly facilitate the aerial excursions of the crustacean and uphold it after it has once risen into the air by a leap. We might multiply the descriptions of the species, but it seems to us that what we have said will suffice to convince our readers. Let us add that our figures were prepared from the plates of the excellent monograph of the copepods of the Gulf of Naples published by Mr. Giesbrecht in 1892.

If the pontelline, with its relatively small hairs, can

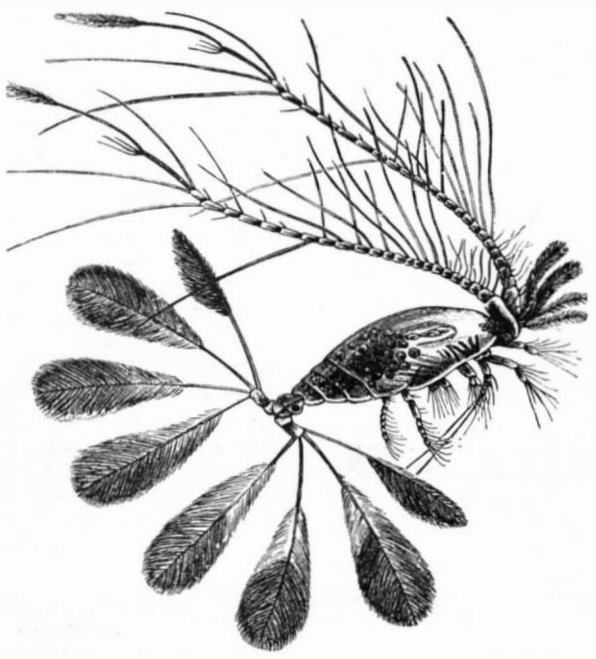

Fig. 1.—CALOCALANUS PAVO. (×20.)

sustain itself for a few instants in the air, the two other crustaceans that we have mentioned are still more capable of doing so with their wide penniform appendages.

According to Mr. Ostroumoff, whose interesting communication has been reproduced in one of the last numbers of the Zoologischer Anzeiger of Leipzig (October 22, 1894), the flight of the pontellines has some connection with the phenomenon of moulting. It would notably facilitate the beginning of this act, which is always very troublesome to animals. We know at least that other crustaceans of the group of Entomostraceæ, such as certain Polyphemides (Evadne, Pleopis, etc.) maintain themselves at the period of moulting upon the surface of the water, or a little above it, thanks to a float formed by their old cuticular envelope, cast off and filled with air.

However this is, the demonstration of this faculty of flight in crustaceans is still another proof that nature varies its processes to infinity in order to attain the same end. In mammals and reptiles we see aerial locomotion assured by the aid of interdigital membranes or by that of a portion of the skin stretched between the limbs. In fishes and insects, it is rendered possible in consequence of the transformation of the limbs (fins or dorso-lateral appendages of the thorax) into membraneous wings. Finally, in the birds and in the crustaceans, such locomotion is effected through the aid of apparatus formed of feathers (wings and feathery appendages). The last word of the scientific observation is not yet said, and it may be that we shall find in animals still other means of aerial locomotion besides those that we have just mentioned.

Who knows whether man, in imitating the processes of nature, will not some day succeed in surmounting certain obstacles, such as watercourses, ditches, walls, etc., by rising in the air and supporting himself for some time therein, as Mr. Lilienthal has recently tried to do? The practical applications of the idea of short distance aerial locomotion might render appreciable services in the military art, and would also be of great help to explorers and pioneers in countries destitute of roads.—La Nature.

The Greenland Scientific Expedition of 1895.

Efforts are now making to raise a fund of $12,000 for the purpose of bringing Mr. Peary and his two assistants home from Northwest Greenland early next fall, and, in connection with this, to prosecute scientific investigations during the available summer season. It is hoped by this means to charter and fit out a staunch steamer built for Arctic service and commanded by experienced Arctic navigators, which shall start from St. John's, Newfoundland, on or about July 5, 1895, for Inglefield Gulf, Northwest Greenland, latitude 78° N., Mr. Peary's headquarters. The co-operation of museums, scientific and educational institutions and individuals is invited, not only because they will thus assist in the return of Mr. Peary and in the preservation of the results of his extended labors, but also because such an expedition will afford the most favorable advantages to eight or ten specialists for obtaining the rich results that are possible in a prolific field that, for a generation to come, may not again be easily and economically accessible.

Mr. Peary, who has done great service in opening this interesting region to scientific study, will render every aid in his power to the expedition. His thorough knowledge of the natives, of methods of travel and work, and of points of interest, will greatly facilitate the present undertaking; and conspicuous among its results will be the fact that it will bring back, not only the fruits of its own labors, but also the product and records of the able and brilliant explorer who, for several years, has devoted all his time, energy and money to the study of Arctic life and phenomena, and to widening the bounds of geographic knowledge in the North Polar area.

The American Geographical Society contributes one thousand dollars toward the expenses of such expedition, provided that other subscriptions, sufficient to make up the sum required to send the expedition, are obtained.

A limited number of scientific societies, educational institutions, or individuals, contributing $1,000 to the fund, will be entitled to have each a representative on the expedition, who shall be approved by the scientific leader. The expenses of each member over and above $1,000 will be the cost of his scientific outfit, transportation from his home to St. John's, and from New York or Philadelphia to his home. The proposed work will require three months. Further information can be had from Emil Diebitsch, 2014 Twelfth Street, N. W., Washington, D. C.

Direct Laryngoscopy.

Dr. Kirstein, of Professor Senator's polyclinic in Berlin, has devised a new method of examining the larynx and trachea, in which the interior of these organs is seen directly and not by the intervention of a mirror or prism. He does not say, however, that his plan is applicable generally, but only that in "many persons" it can be carried out. The patient is placed on his back in the horizontal position, with the head hanging down, and an œsophagoscope is introduced. A metal speculum in the form of a tube about ten inches in length can then be passed behind the epiglottis and illuminated by a "Caspar's electroscope" and through it the larynx viewed with the naked eye. It does not do for the observer to wear spectacles, as these rapidly become dimmed with moisture. The tube itself acts as a tongue depressor, being a lever whose fulcrum is the edge of the upper incisors. Dr. Kirstein does not, of course, suggest that this method should ordinarily be employed instead of the common method of

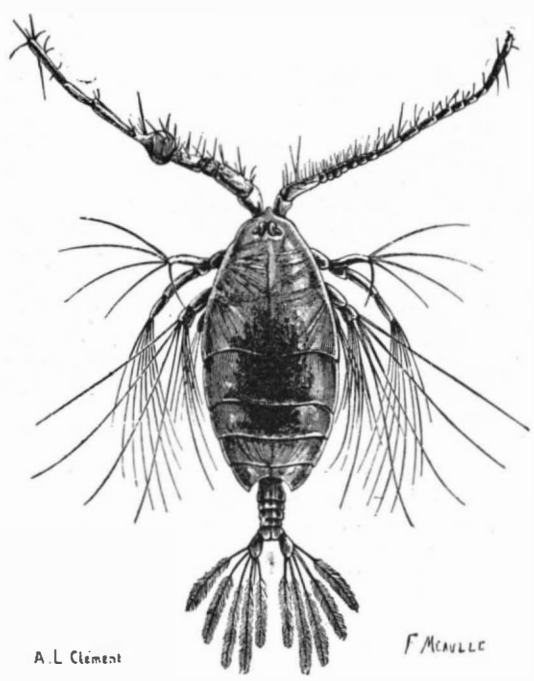

Fig. 3.—PONTELLINA PLUMATA, DANA. (×30).

laryngoscopy, but he thinks that in some cases it will be found capable of extending usefully our methods of laryngeal and tracheal examination, and he asserts that it is by no means so severe a procedure as may be imagined, and that, especially if cocaine is employed, it causes the patient no distress either at the time or subsequently.—Lancet.

Temperature of Incandescent Filaments.

Prof. Weber has lately given the results of a number of experiments made by him to determine the temperatures of filaments in electric incandescent lamps. He has found that the normal temperatures of all species of incandescent lamps is approximately the same, and is comprised between 1,565° and 1,588° C. In the case of some lamps giving a very brilliant light—that is to say, with very thick filaments—the temperature is 40° higher.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

LOCOMOTIVE BELL RINGER.—Henry Breitenstein, Laramie, Wyoming This inventor has devised a bell-ringing mechanism in which the steam operates a plunger or piston in one direction only, the movement in the reverse direction being effected by the weight of the bell. It comprises a cylinder with inlet and exhaust ports, and a shifting valve having a port discharging against the operating piston. this port being alternately brought in register with the inlet and exhaust ports. The cylinder also has a supplemental port discharging under the shifting valve, so that when the piston reaches its uppermost point the air or steam will pass down under the shifting valve and shift it to an exhaust position.

CAR FENDER.—Marguerite and Victor F. Maidhof, New York City. This is an improvement on a formerly patented invention of the same inventors, providing for a yielding connection between the fender and the car body, so that any motion of the car will not interfere with the fender, and roller bearings are provided for the pivot of the fender, to operate in conjunction with the yielding connection. A better rolling support is also devised for the receiving member of the fender, which has a special guide in case it is used with cable roads or underground trolleys, or when a slot occurs between the track rails. The entire fender remains at all times close to the pavement and under the platform of the car, its forward supporting wheels traveling upon the rails.

DROP BOTTOM CAR.—Henry D. Carryl, New York City. The hinged bottoms of cars may, according to this improvement, be conveniently operated for wholly or partly and positively opening or closing the bottoms, and holding them in any desired position. Connecting rods or links are pivotally connected with the free ends of the hinged bottoms, and the rods are also pivotally connected with a movable head having an interior screw thread screwing on a screw rod. On the lower ends of the two screw rods on the sides of the car are bevel gear wheels on a transverse shaft adapted to be turned with a crank arm or wrench, positively and simultaneously moving both doors. The car bottom doors have no interior connections, and the loaded material does not interfere with the operating devices.

Electrical.

STOP MOTION FOR WARPING MACHINES.—Clayton Denn, John Cocker, and Charles Denn, Philadelphia, Pa. This is an improvement on a formerly patented invention of the same inventors, insuring a positive action of the circuit closer at all times, the thread guides permitting slacking in the threads without closing the circuit and stopping the machine. The thread guides are pivoted on a conducting strip forming one terminal of the circuit, the pivoted ends of the guides having a sliding connection with the strip and a contacting strip forming the other terminal of the circuit, while an inclined contact surface is adapted to be engaged by the lower bent ends of the guides.

Mining.

PLACER MINING.—Samuel S. Harper, Denver, Col. This inventor has devised a method and apparatus for raising gold-bearing gravel and delivering it into a flume or sluice boxes, with means for draining the pit which the dredger digs. The stream is dammed and diverted around the pit, washing the dredged gravel and draining the pit, while the bedrock is cleaned up and the scrapings washed. A dredger is employed to raise the gold-bearing gravel and deliver it to a flume or a series of sluice boxes, the latter being formed of removable or separable connections suspended from trolleys movable on transverse cables. A channel is kept flooded by a temporary dam, in which the dredger may float and be at work while the pit previously digged is having its bottom scraped.

Mechanical.

COTTON ELEVATOR AND DISTRIBUTER.—Friedrich Zedler and Perry L. Ward, Cuero, Texas. This invention is for a mechanical conveyer in connection with a blast device, making a positive force feed, placing the cotton evenly over the gins. An overflow box is employed and independent means of feeding the cotton through the blast device, or from a vehicle or bin, or from the overflow box. The blower or fan employed in connection with the pneumatic conveying device may also be used for forcing the seed delivered from the gin to any desired point. The machine is very simple and inexpensive, and is designed to have a substantially perfect force feed.

PRINTING METALLIC CAPSULES.—Falk Lewin, Herzogenbosch, Netherlands. For printing in colors the side surfaces of these capsules, such as are used to close vessels, or as etiquettes on the mouths of bottles, this inventor has devised an apparatus consisting of two movable frames pivoted on independent parallel pivots, the frames being engaged by screw-threaded portions of a rotatable spindle, while a shaft journaled in one of the frames carries a holder for the article to receive the impression. In the other frame are journaled two shafts. one forming a holder for the impression head and the other carrying an inking head. The coloring thus produced is very durable and difficult to remove, and the work is rapidly performed.

Agricultural.

CORN PLANTER.—Albert J. Helvern and Joseph W. McGuire, Burrows, Indiana. This planter is designed to accurately check row, the parts being automatically operated and driven from one of the ground wheels, and the construction being exceedingly simple and inexpensive. The check markers drop in making a mark, and move rearward with a timed movement while the mark is being made. The mechanism operating the drop slide is controlled by a trip device operated by a wheel independent of the frame of the machine and located to track one of the ground wheels. It is designed that, with a complete revolution of this regulating wheel, tracking either of the ground wheels, two hills shall be planted.

THRASHING MACHINE.—William H. Bowen, Wise, Michigan. This improvement provides for a movement of the straw discharge fork, the straw being also shaken to discharge any grain clinging to it. The fork is near the delivery end of a series of carriers which have a rotary and reciprocating movement, the fork being pivoted to a fixed support, while a shaft journaled below its tines carries S-cams with shoulders at each side of their centers, the shoulders alternately engaging the tines to raise them, while the points of the cams extend upward between the tines and toss the straw.

PLOW SUBSOIL ATTACHMENT.—Le Roy McWhinney, Creston, Ia. The common plow may be readily connected with this attachment without disconnecting or rearranging any of the parts. The subsoil attachment has a supporting portion at the right side of the shear edge, to cause it to run level and take off the strain of the weight of dirt raised, and the right side of the shear or cutting plow is arranged parallel with the land side, so that when the cutting edge wears away and is sharpened it does not become narrower. When a pair of these attachments is secured to the plow, one of them may be fastened to the plow standard and the land side.

STUMP PULLER.—Charles F. Anthony, Cedar Rapids, Ia. This device comprises a windlass on a heavy plank, the base of the windlass having a hook to be engaged by a rope or cable connected with a tree or other support, and there being at its top a cap which may be conveniently engaged by a sweep. On the post of the windlass is a spool carrying a cable which passes through tackle blocks, one of which is connected by a rope or chain with the stump to be pulled, while the other tackle block is connected with a near-by stump or other fixed point. A novel slack-taking-up device is provided for the draught cable, and the whole apparatus is very simple, a small power only being required to pull heavy stumps.

Miscellaneous.

BUTCHER'S DERRICK.—Charles F. Brown, Shreveport, La. This is an inexpensive, easily handled tripod, to be erected by the windlass it carries, to facilitate lifting a carcass in position for taking off the hide and for other work upon it. It comprises three pivoted legs, on one of which is a roller which rolls upon the ground, and on one leg is a windlass, the hoisting rope or cable being so arranged that it may also be used in stripping the hide or skin from the animal.

BACK PAD FOR HARNESS SADDLE.—John S. Powell, Marshall, Texas. This inventor has devised a back pad having a concave top enabling the saddle to fit nicely upon it, the concavity being made in a cheap and simple manner, and the pad top being neatly and inexpensively finished. The pad back has transverse holes at opposite sides of its center, the outer edges of the holes being stitched together and the strip between the holes being fastened to the pad at its edges to overlap the edges of the holes.

OPERATING ORGAN PRESSURE BELLOWS.—William Schwarze, Brooklyn, N. Y. This improvement provides simple means for operating pressure box bellows to provide for a quick response between the pressure of a key and the sound of an organ tube, the valve or pallet controlling the bellows being actuated either by pressure or exhaust. The operation is very quick and the construction simple and quite inexpensive.

PENCIL ATTACHMENT.—Cyrus C. Clark and Albert J. Vick, Waterloo, Wis. This a ferrule-like spring clasp, open on one side, and adapted to be readily clamped upon a pencil. An elongated spring knife has its shank secured to the outer side of the clasp, an outwardly bowed portion causing the free end of the blade to lie along the surface of the pencil, and the attachment thus forming a convenient envelope opener and paper knife.

LAMB'S WOOL OR SLIPPER SOLE.—Samuel Borchardt, New York City. This invention relates to soles for crocheted uppers, and provides a sole which does not require binding. A stiffening strip is secured to an upper strip of soft material, a fastening strip of leather or similar material being cemented to the stiffening strip, while the finishing or bottom strip is wider than the other strips, and has a draw string at its margin, by drawing up which the margins of the other strips are concealed. The sole thus formed has an upwardly extending flange for attachment to the upper, the string likewise being a medium for attaching the upper to the sole if desired.

OVERSHOE FASTENER.—Wakefield C. Arnold, Columbus, O. This is a device for automatically locking the overshoe at the heel upon the shoe proper, readily releasing the overshoe when desired. It consists of a thin plate-like bracket piece embedded in the material of the overshoe at the heel, and embracing and interlocking with a spring dog adapted to engage the heel crease of a leather shoe where the heel joins the upper. The overshoe is thus locked in place when the leather shoe is pressed down into it, and may be released by pressing together the upper limbs of the dog, when the latter may be drawn away from the heel of the leather shoe.

SEWING MACHINE FELLING ATTACHMENT.—Joseph W. Betz, Brooklyn, N. Y. This device consists of a sheet metal scrolled piece of special outline formed on or secured on an extended end portion of the base plate. The device affords means for convenient adjustment to gage the width of the welt, and insure an even width for felled seams, which may be readily felled thereby at any point on a garment on an ordinary sewing machine, the attachment particularly facilitating work on the back and sleeve seams of tailor-made coats.

BATHING APPLIANCE.—Joseph L. Prentiss, Canon City, Col. This inventor provides a hollow head from which water is forced under pressure against the body through a diaphragm having many small passages, the water being projected from the pressure head against submerged portions of the body, especially against sore joints, and the device thus acting as a massage bath, affording pleasurable sensations, stimulating the circulation of the blood, and effecting a thorough kneading action.

METAL MIRROR FRAME.—Albert Wanner, Jr., Hoboken, N. J. For the manufacture of frames for mirrors, stands, etc., this inventor provides a stock or material that may be bent into form without buckling. It consists of a flexible narrow strip of sheet metal having at one edge an outward and an inward bend overhanging the body of the strip, and legs secured exteriorly on the strip, the points of connection on the strip being overhung by the outward bend.

CURLING AND CRIMPING IRON.—John H. Broomall, Baltimore, Md. The members of this iron approach and recede from each other by a parallel motion, so that they do not have a tendency to pinch and burn the hair near the handles nor hang in the hair at their outer ends when opened. The device has a single handle, having a mandrel and parallel clasp member, a spring-seated slide being laterally adjustable in relation to the handle and carrying one of the members of the curling iron.

DESIGN FOR A WHIFFLETREE.—Rice E. Gregory, Owensborough, Ky. This whiffletree has its ends curved and extended to form arms at an angle to the longer central portion, the arms terminating at each end in returned ends or hooks.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each, Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

A TEXT BOOK OF CHEMISTRY. Intended for the use of pharmaceutical and medical students. By Samuel P. Sadtler and Henry Trimble. Philadelphia: J. B. Lippincott Company. 1895. Pp. 950. Price $5.

This very beautifully printed work seems to be a really admirable contribution to chemical science. It is designed for the library of the physician, and of students in chemistry, pharmacy, and medicine. It contains a brief outline of quantitative and qualitative analysis, including a number of pharmaceutical assays according to the pharmacopœia. It opens with a course in elementary physics, treating of the special properties of matter, heat, light, and magnetic and electrical energy. It then treats successively of the chemistry of the non-metals and of the metals, of organic chemistry and of analytical chemistry and pharmaceutical assaying. In this one volume a singularly complete resume of pharmaceutical science is found, the whole making a very attractive contribution, and covering the entire field of mechanics, physics, and chemistry.

MINERAL RESOURCES OF THE UNITED STATES. Calendar year 1893. Washington: David T. Day. 1894. Pp. 810.

It is doubtful if any of the government publications are entitled to more favorable notice than are this series of reports, of which ten volumes have now been issued. It is sufficient to say that the present volume, edited by David T. Day, covering the calendar year of 1893, is of the full standard of merit established by its predecessors. As its letter of transmittal indicates, it is a species of farewell to Major Powell, long known as the head of the United States Geological Survey. It is to be hoped that the publication will be continued in the future, the one criticism being that it is always somewhat in arrears.

ANTISEPSIS AND ANTISEPTICS. By Charles Milton Buchanan, M.D. With an Introduction by Professor Augustus C. Bernays. Newark, N. J.: The Terhune Company. 1895. Pp. xvi, 352.

This very useful work covers considerable ground and will be found of decided interest. It contains numerous biographical notes and its illustrations include some very suggestive and rather dreary ones of surgical practice as produced by the artist from the field of actual hospital practice. The author advocates the unfortunately odoriferous dry dressing as superior to wet dressing. There are two indexes, one of subjects and one of authors, besides the table of contents. These features constitute an effective testimony to the careful preparation of the book.

GARDENIER'S READY HELP FOR LOCOMOTIVE ENGINEERS. Being an educational chart for locomotive firemen seeking promotion, for the scholar and student, and for the help of the examiner when employing or promoting new men; and is a ready help to engineers while on the road, it comprising a remedy for every conceivable breakdown or disorder that may occur to a locomotive. By Norman Gardenier. Philadelphia: Edward Meeks. 1895. Pp. 117. Price $1.

This book is a catechism for locomotive engineers, and possesses the very great virtue of having the questions given separate from the answers, so that when a question is given its answer does not immediately follow, and the student can endeavor to answer it before turning over the fifty or more pages which intervene between the question and answer. The book contains 596 questions.

TASCHENBUCH ZUM PRAKTISCHEN GEBRAUCH FUR FLUGTECHNIKER UND LUFTSCHIFFER. Unter Mitwirkung von Hauptmann H. Hoernes, Dr. V. Kremser, Ingenieur P. Lilienthal, Dr. A. Miethe, Professor Dr. K. Mullenhoff u. A. Herausgegeben von Hermann W. L. Moedebeck, Hauptmann und Kompagnie-Chef im Schleswig-Holsteinschen Fuss-Artillerie-Regiment Nr. 9. Mit 17 Textabbildungen. Berlin W.: Verlag von W. H. Kuhl. 1895. Pp. 198.

THE POCKET LIST OF RAILROAD OFFICIALS. Containing the names of officials in charge of railroads, private car companies, fast freight lines and transportation companies of the United States, Canada and Mexico. Also showing the gage of each road, number of miles operated, and rolling stock in service of each company. New York: Published by the Railway Equipment and Publication Company. G. P. Conard, President and Treasurer; J. Alexander Brown, Manager, 326 Pearl Street. Pp. 292. Price $1 per annum.

BOILER INCRUSTATION AND CORROSION. By F. J. Rowan. New edition. Revised and partly rewritten. By F. E. Idell. New York: D. Van Nostrand Company. 1895. Pp. 118. Price 50 cents.

This little work is to be recommended to the users of boilers. It brings out strongly the evils to be avoided and contended with in preserving boilers from deterioration.

THE CENTURY MAGAZINE.—The Century Company, 33 East Seventeenth Street, New York, have just issued in handsome binding the Century Magazine for the last six months, from November, 1894, to April, 1895. Price $3. In this volume Thomas Comerford Martin describes and illustrates with half tone prints Tesla's most important inventions, and a full description, with illustrations, of Maxim's flying machine, which has attracted much attention abroad and in this country. This article is written by the inventor, in which he claims to have solved the air ship problem. The new weapons of the United States army, with eighteen illustrations, in which the writer, Victor Louis Mason, claims that our equipments are now equal to those of any European nation. It is needless to add for the information of the regular readers of the Century that this volume contains other articles of equal interest to those denoted, by leading writers of the day.

SCIENTIFIC AMERICAN

BUILDING EDITION.

MAY, 1895.—(No. 115.)

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1. Plate in colors, showing a residence at Glen Ridge, N. J., recently erected for W. T. Taliaferro, Esq. Perspective elevation and floor plans. A fine example in the Colonial style. Mr. Chas. E. Miller, architect, New York.
2. Perspective elevation and floor plans of a cottage at Tenafly, N. J., erected for Chas. Vogt, Esq., at a cost of $5,800 complete. Mr. W. L. Stoddart, architect, New York. An attractive design.
3. A dwelling at Kennebunkport, Me. Three perspective elevations and floor plans. A most picturesque residence, with many artistic features. Mr. Henry P. Clark, architect, Boston, Mass.
4. A log cabin chapel recently erected at Black Rock, Conn. Perspective elevation and ground plan. Mr. Bruce Price, architect, New York.
5. A cottage at Park-Hill-on-Hudson, N. Y., recently erected for Geo. L. Rose, Esq., at a cost of $12,000 complete. Two perspective elevations and floor plans. Mr. A. F. Leicht, architect, New York. A well executed design, showing many excellent features.
6. A house at Orange, N. J., recently completed for Thomas L. Smith, Esq. Messrs. Child & De Goll, architects, New York. A pleasing design in the Colonial style.
7. The Yonkers Public School, No. 8, at Bronxville, N. Y. A good example of school architecture.
8. A dwelling of modern design, recently erected for M. Strong, Esq., at Montclair, N. J. Two perspective elevations and floor plans. Cost complete, $6,000. Mr. Christopher Myers, architect, New York.
9. A house at Indiana, Pa. Perspective elevation and floor plans. Cost complete $3,100. Architect, Mr. E. M. Lockard, Indiana, Pa. An attractive design in the Colonial style.
10. A very attractive residence at Montclair, N. J., erected for Frederick S. Gage, Esq. Perspective elevation and floor plans. Mr. E. R. North, architect, Montclair, N. J.
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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(6538) C. A. G. writes: I am making a chime of three whistles, the bells to be of 2 inches brass tubing, ⅛ inch thick, the longest tube or bell to be 8 inches. The cap piece will extend into top of bell about ⅜ inch, of course shortening air column that amount. The longest bell being the key note, I wish the others to be higher in pitch, and all to range as do, me, sol, or as in key of C major, C, E, and G. I wish to know of what length to make each of the other two bells, and also about what size opening should I give the steam vent under the bells with steam pressure of 150 pounds. A. The making of a chime whistle is a matter of experiment until the relative conditions are found. Make the low tone whistle first, then use a sliding plug in the bell for regulating the tones of the other whistles. The steam slot should be about one-fiftieth of an inch opening.

(6539) J. H. M. writes: I have two nests of boilers, six in a nest, and what is the horse power of each boiler, or what is the horse power of 12 boilers? Each boiler is 47 feet 7 inches in length by 30 inches diameter. Fire box 16 feet in width by 6 feet in back. What is the cause of a set of boilers foaming when the fires are kept all the same heat, bridge wall the same height, and water enough going in boiler continually? A. If your boilers are plain cylinder boilers, without flues, they are 19 horse power each, or 228 horse power for the 12. The foaming is probably caused by driving too hard, or by bad water.

(6540) W. S. M. writes: I purpose to lay some old 2½ inch and 3 inch pipe along both sides of the shop about 7 feet from the floor for heating purposes. Engine exhaust 4 inches. My idea is to connect with two 3 inch pipes and go down each side, which is 78 feet, and return with 2½ inch pipes; this will use all we have got, but will return the second time if you think feasible. Or would it be better to have the exhaust discharge into one 3 inch and 2½ inch to begin with and have no return? Size of shop 78 feet by 38 feet. A. The plan of dividing the exhaust with a 3 inch pipe and returning with a 2½ pipe on each side is correct. The last ends of the return pipe should be open, so as to allow drip and excess of steam to escape freely. This arrangement prevents undue back pressure in the engine. All pipes should be laid to allow water of condensation to run with the steam to drips or to the end of the line.

(6541) J. H. asks for a rule to find strain brought on staybolts. Also how to find horse power of an engine with the indicator. How to find displacement of steamship. A. The strain on a staybolt is the whole area of plate due to any one bolt multiplied by the steam pressure. If the stays are 6 inches apart in each direction, the area is 36 inches. You will need a book on the indicator for the horse power problem. See Pray's book, "Twenty Years with the Indicator," $2.50 by mail. The displacement is also an intricate problem. See Haswell's "Engineer's Pocketbook," $4 by mail.

(6542) W. H. P. says: Inclosed is a twig from a Pirus Japonica bush growing in Philadelphia, which seems to be suffering from a white scale covering most of the stems, some of which are already dead and others dying. What is the remedy for this, if any? A. Answer by the Entomologist, United States Department of Agriculture.—This is the common scurfy bark louse (Chionaspis furfurus) found abundantly on pear, apple, etc. Spray about June 1 with dilute kerosene emulsion (1 part to 10 of water) or during winter with 1½ pounds whale oil soap to 1 gallon of water.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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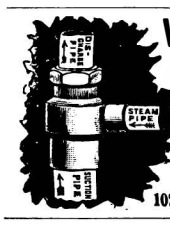

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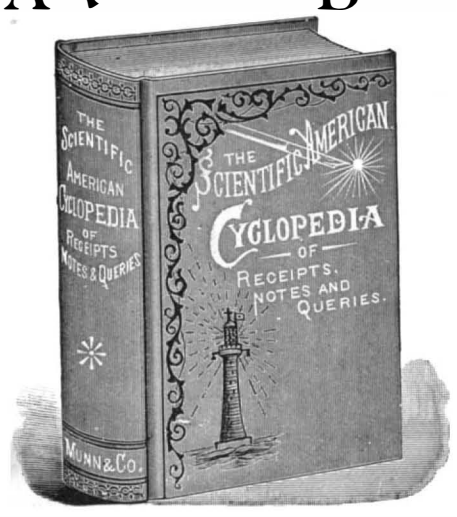

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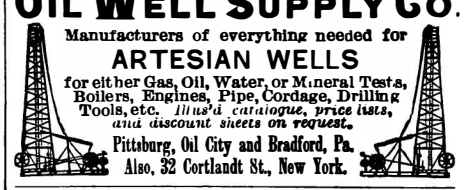

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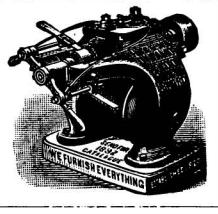

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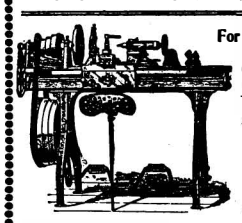

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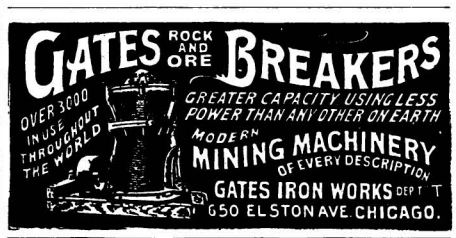
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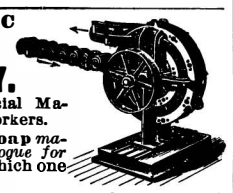

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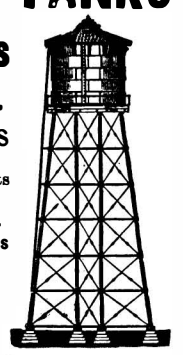

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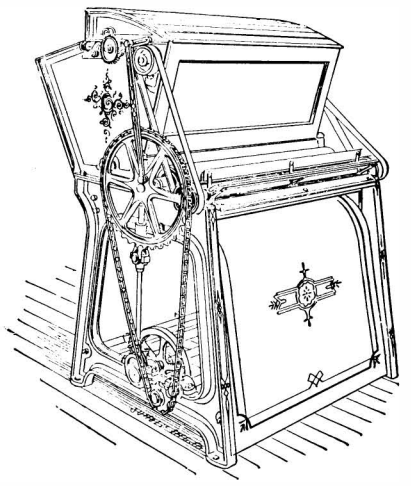

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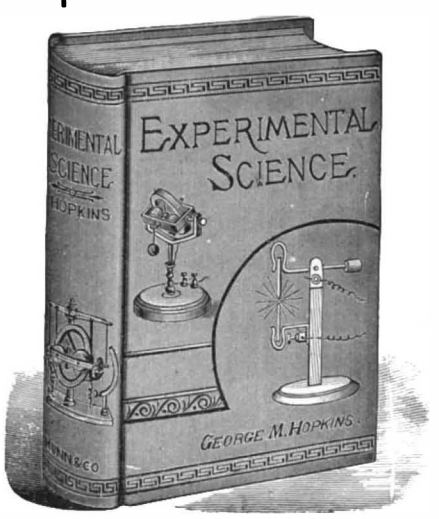

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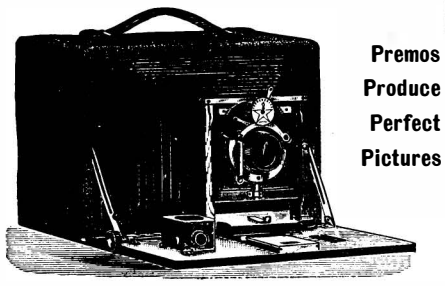

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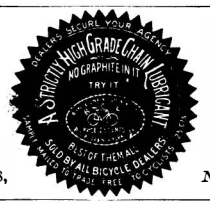

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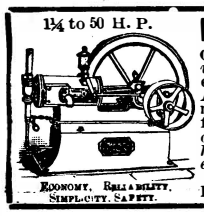

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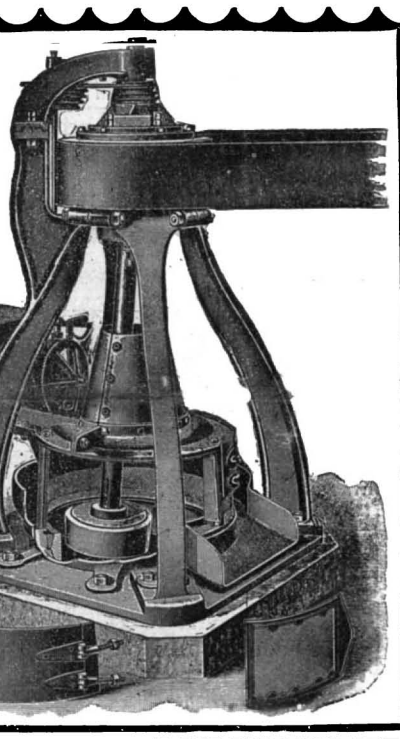

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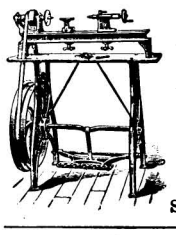

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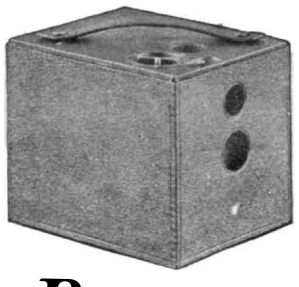

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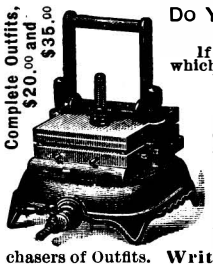

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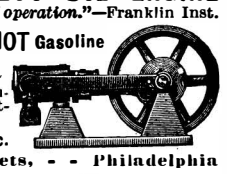

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